

MINNESOTA ALGAE

VOLUME I

THE MYXOPHYCEAE OF NORTH AMERICA AND ADJACENT REGIONS
INCLUDING CENTRAL AMERICA, GREENLAND, BERMUDA,
THE WEST INDIES AND HAWAII

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REPORT OF THE SURVEY

BOTANICAL SERIES

VIII

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PREFACE

Although the recent appearance of the last volume of De Toni's "Sylloge Algarum," the "Myxophyceae," has removed some of the greatest difficulties which confront the student of this branch of Algology, yet, with the general literature concerning the blue-green algae in its present state, he has a vexatious problem before him if he attempt to work to any purpose in this group of plants. The original specific descriptions with their accompanying notes and figures, are scattered far and wide, many of them in foreign periodicals and rare works. In general these cannot be obtained in more than a very few of the largest botanical libraries. In the United States, at least, there is much need for a work in English, suitable for use as a general hand-book, which shall contain descriptions and illustrations of these plants. On the other hand, such a work ought not to be written until a considerable amount of information has been obtained from all parts of the country. An accurate treatise of this sort should be prepared only as a result of general investigation carried on by a large number of workers over the entire area to be covered, at all seasons of the year. For instance, many species have so far been reported from a single locality, which without doubt are growing in profusion in other parts of the country. Without question numerous new species await discovery when the study of the group has become more general.

It would seem then that two books need to be written, one as a cause and one as a result of such investigation. If the present treatise proves to be of use as a foundation or ground-work for the second volume, and if it shall be the means of assisting those who are disposed to follow this fascinating branch of microscopic study, the hopes of the author will be realized. The work has been prepared with a view to answering the need of such botanists as do not have access to the special libraries and of others who have not unlimited time to devote to the looking up of literature. Special prominence has been given, in the arrangement of the text, to two features. The student has constantly before him practically all that is known relating to the *geographical distribution* and the *recorded history* of each plant in American localities. To quote from Mr. G. S. West, "One cannot emphasize too much the importance of a sound knowledge of the geographical distribution of some of the more lowly types of Cryptogams. . . . Such a knowledge, which can only be acquired by the patient labors of the systematist, will throw much light on one of the most interesting of all problems concerned with the later phases of the earth's history, namely, the land-connections of previous periods." It is very much hoped that this volume may encourage interest on the part of general botanists, high school teachers, college students, physicians and bacteriologists in these little plants which are of late coming to be considered of importance even outside of botanical circles.

In the present volume the author has brought together the specific descriptions of all the blue-green algae so far known to exist in North America and the adjacent regions (including the Arctic Regions, Alaska, Greenland, Canada, Newfoundland, Labrador, the United States, Lower California, Mexico, Central America, the Bermudas, the Bahamas, the West Indies and the Hawaiian Islands). In addition there are figures illustrating many of the species. The figures have been photographed from the original and redrawn. A number of them are original with the author. An attempt has been made to have the figures all drawn to the same scale which may be an improvement over the ordinary method. Very simple keys are furnished for the families, genera and species. The second paragraph of each specific description contains the names in chronological order of a number of articles and works referring to the species in question. It is

believed that the plan of writing out in full the author's name and the title of his article will prove a great saving in time for the one who uses the book. In the case of amateurs it will also serve to give in a short time an intimate knowledge of the names of algologists and an idea of the work already done in the group.

The descriptions in general follow those of Gomont, Bornet, Thuret and Flahault. Constant reference has of course been made to Forti's recent volume. Wherever possible the original descriptions have been consulted. Possibly a mistake has been made in not repeating the synonym after each title. Instead each synonym has been inserted but once, following the first article in which it occurs. The principal aim of the book, however, is to encourage original investigation in the field among the plants themselves. For a full list of synonyms, reference must be made to De Toni's "Myxophyceae."

I wish to tender my best thanks to Dr. Frederic E. Clements for advice and much kind assistance during the preparation and publication of this volume which was undertaken at his request. To Miss Charlotte Waugh I am much indebted for her painstaking work upon the pen and ink drawing of the figures.

The author hopes that several persons in each state or section of the country may decide to undertake a systematic and careful investigation of the blue-green algae in their neighborhoods, and would be very glad to enter into a correspondence with such workers.

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December 21, 1909.

MYXOPHYCEAE

(Cyanophyceae. Schizophyceae) The Blue-Green Algae

Algae typically blue-green, the coloring matter being a mixture of two pigments, chlorophyll and phycocyanin; pigments of other colors sometimes present.

Plant body unicellular or multicellular, sometimes endowed with a peculiar motion; plants existing usually in gelatinous masses, sometimes solitary among other algae.

Reproduction always asexual, either by simple cell division in one, two or three directions of space, or by means of hormogones (multicellular fragments of the plant body, at first motile, afterwards coming to rest), or by means of non-motile gonidia formed within gonidangia, or by means of resting gonidia (formed from ordinary cells).

Habitat: Plants found in fresh, brackish or salt water, in hot springs, in mineral springs, in aerial situations, or as endophytes.

Order I. **Cocconeae**. Plants unicellular, single or associated in families or colonies which are usually surrounded by a copious gelatinous integument, rarely forming filaments; reproduction occurs commonly by the vegetative division of cells, rarely by the formation of non-motile gonidia from the division of the contents of a gonidangium (mother cell).

Order II. **Hormogoneae**. Plants multicellular, filamentous, attached to a substratum or free-floating; filaments simple or branched, usually consisting of one or more rows of cells within a sheath; reproduction occurs by means of hormogones or resting gonidia.

Order I. COCCOGONEAE

Family I. **Chroococcaceae**. Plants showing no difference between basal and apical regions, solitary or associated in families or colonies;

reproduction by vegetative division of cells in one, two or three directions of space.

Family II. **Chamaesiphonaceae**. Plants often showing a difference between basal and apical regions, solitary or associated in families or colonies, usually epiphytic or attached to shells; reproduction by means of non-motile gonidia formed by the division of the contents of a mother cell (gonidangium).

Family I. CHROOCOCCACEAE

I. Plants solitary or associated in small, indefinite families or colonies, not surrounded by a common (colonial) gelatinous tegument.

1 Cells spherical; reproduction by cell division in three directions

Chroococcus

2 Cells spherical; reproduction by cell division in one direction only

Synechocystis

3 Cells oblong, ellipsoidal or cylindrical; sheath wanting; reproduction by cell division in one direction only

Synechococcus ✓

4 Cells cylindrical or oblong-conical; sheaths thick, hyaline; reproduction by cell division in one direction only

Chrootheca ✓

II. Plants associated in families or colonies, surrounded by a common gelatinous tegument.

1 Colonies without definite shape

(1) Individual sheaths usually thick, remaining through many divisions, sheath of original mother-cell surrounding entire colony

A Cells spherical

a Cells enclosed in a vesicle-like, thick, colorless or colored sheath, spherical (after division oblong), single or in colonies; cell contents blue-green, or of various colors

Gloeocapsa

b Cells surrounded by an elliptical membrane, forming colonies, arranged in short filaments

Entophysalis

c Cells surrounded by thick sheath, forming spherical colonial masses; plant mass cushion-like, cartilaginous, incrustated with lime at base, curled at periphery

Chondrocystis

B Cells elongate

a Cells cylindrical-oblong, surrounded by a thick, mucous sheath, solitary or forming small colonies

Gloeotheca

(2) Individual sheaths not distinct; colony surrounded by common tegument formed of dissolved individual sheaths

A Cells spherical (or angular from mutual pressure); cell division in all directions

Aphanocapsa

B Cells oblong; cell division in one direction

Aphanotheca

2 Colonies having a definite characteristic shape

(1) Colonies free-floating

- A Cells having an indefinite arrangement, forming several layers
 - a Cells spherical or oblong; colony spherical or oblong, solid
Microcystis
 - b Cells spherical; colonies of variable shape, at first solid, becoming saccate and clathrate
Clathrocystis
 - c Cells pear-shaped or heart-shaped; colony spherical or ellipsoid, solid
Gomphosphaeria
- B Cells having a definite arrangement, forming a single layer or cube
 - a Colonies spherical, hollow
 - (a) Cells spherical, lying just within the periphery of the colony
Coelosphaerium
 - (b) Cells spherical or elongate; individual sheaths distinct
Coelosphaeriopsis
 - b Colonies flat
 - (a) Cells of some definite or symmetrical shape, quadrangular or triangular, solitary or forming colonies
Tetrapedium
 - (b) Cells spherical; colonies rectangular
Merismopedium
 - c Colonies cubical, solid; cells spherical or elliptical
Eucapsis
- (2) Colonies adherent to substratum
 - A Cells spherical or elongate, regularly arranged in radial rows; colonies cushion-like, hard, leathery, verrucose
Oncobyrsa
 - B Cells spherical or oval, irregularly arranged in radial rows; colonies irregularly lobed, epiphytic
Chlorogloea

Genus **CHROOCOCCUS** Naegeli. Gatt. Einz. Alg. 45. 1849.

Plants either free-floating or forming a gelatinous or crust-like plant mass in damp places, in fresh or salt water, or within the tissues of other plants, occurring as spherical or angular cells, each surrounded by a more or less definite sheath, solitary or united in twos, fours, eights, etc., but not held together in definite colonies by a common gelatinous tegument; sheaths thin or wide, homogeneous or lamellose, colorless or colored; cell contents homogeneous or granular, usually of a blue-green color, sometimes violet, olive-green, orange or yellowish; reproduction by successive division of the cells alternately in three directions of space.

Sheaths hyaline, often lamellose; cell contents orange or yellowish.

- 1 Cells less than 3 mic. in diameter **C. rubrapunctus**
- 2 Cells more than 15 mic. in diameter
 - (1) Plant mass yellowish green; cells 25-50 mic. in diameter
C. macrococcus
 - (2) Plant mass orange-colored; cells 19-34 mic. in diameter
C. turicensis

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II Sheaths hyaline, yellowish or brownish, often lamellose; cell contents blue-green, rarely olive-brown, reddish-green, brownish-violet or copper-red.

I Cells not embedded in a gelatinous mass, mostly solitary among other algae

(1) Sheaths thick, distinctly lamellose; cell contents blue-green

A Sheaths colorless; cells 13-25 mic. in diameter

C. turgidus

B Sheaths yellowish or brownish; cells 5.8-11 mic. in diameter

C. schizodermaticus

(2) Sheaths not lamellose

A Cells 5-7 mic. in diameter

C. minutus

B Cells 1.7 mic. in diameter

C. multicoloratus

C Growing in hot water; cells 1-1.5 mic. in diameter

C. thermophilus

2 Cells embedded in a gelatinous mass, not free-floating

(1) Sheaths lamellose

A Sheaths slightly lamellose; plants 4-8 mic. in diameter

C. varius

B Sheaths lamellose, finally irregularly peeling off; plants 6-11 mic. in diameter

C. decorticans

(2) Sheaths not lamellose, sometimes scarcely visible

A Plants 5 mic. in diameter, mostly subquadrate, often triangular, rarely multiangular; sheaths scarcely perceptible

C. refractus

B Plants 4-7.5, rarely 9 mic., in diameter, spherical

C. helveticus

C Plant mass pale yellowish; sheaths oblong-elliptical; cells 7.5-13 mic. in diameter; cell contents blue-green, yellowish or orange

C. pallidus

D Plant mass green, later becoming black; sheaths distinct, ellipsoid; cells 2.7-6.6 mic. in diameter; cell contents blue-green

C. cohaerens

E Plant mass blue-green or olive; sheaths scarcely visible; plants 3-4 mic. in diameter; cell contents blue-green

C. minor

F Plant mass lead-colored or green becoming black; sheaths thick, mucous; plants 3-8 mic. in diameter; cell contents blue-green

C. membraninus

3 Cells embedded in a gelatinous, free-floating mass

(1) Plants 8-13 mic. in diameter, much crowded; cell contents green or blue-green

C. limneticus

(2) Plants 13 mic. in diameter, usually in groups of two; groups lying apart from each other; cell contents grayish-purple

C. purpureus

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1. **Chroococcus rubrapunctus** Wolle. Bull. Torr. Bot. Club. 6: 181. 1877. De Toni. Syll. Algar. 5: 8. 1907.

Plants 2-2.5 mic. in diameter, spherical, single or in masses, aquatic; sheaths thin, gelatinous; cell contents homogeneous, yellowish-orange, surrounding a large orange-red area.

Pennsylvania. Not infrequent on boarded sides of basins and old timbers. (Wolle).

2. **Chroococcus macrococcus** (Kuetzing) Rabenhorst. Flora Europaea Algarum. 2: 33. 1865. De Toni. Syll. Algar. 5: 8. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandcensibus a Sv. Berggren 1875 reportatis. 3. 1878. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 614. 1905.

Plate I. fig. 1.

Plant mass more or less extensive, mucous, somewhat thick, yellowish-green; plants 30-80 mic. in diameter, spherical, single or in pairs or fours; sheaths thick, lamellose, colorless, later irregularly peeling off; cells 25-50 mic. in diameter; cell contents homogeneous, yellowish, orange or dark-colored.

Greenland. (Boergesen). **Hawaii.** In stagnant water, Volcano Mauna Kea. Island of Hawaii. (Berggren).

3. **Chroococcus turicensis** (Naegeli) Hansgirg. Prodr. Algenfl. Böhman. 2: 160. f. 58b. 1892. De Toni. Syll. Algar. 5: 9. 1907.

Plate I. fig. 2.

Plant mass gelatinous, smooth, orange-colored; plants spherical, single or in pairs or fours; sheaths moderately thick; cells 19-34 mic. in diameter; cell contents finely granular, orange-colored, rarely blue-green.

Greenland. (Boergesen).

4. **Chroococcus turgidus** (Kuetzing) Naegeli. Gatt. Einz. Alg. 46. 1849. De Toni. Syll. Algar. 5: 11. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus. 3. 1878. **Dickie.** On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 9. 1880. **Farlow.** Marine Algae New England. 27. 1881. **Wolle.** Fresh-Water Algae. U. S. 334. pl. 210. f. 40, 41. 1887. **Collins.** Algae of Middlesex County. 16. 1883; Marine Algae of Nantucket. 4. 1888. **Bennett.** Plants of Rhode Island. 116. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 612. 1889. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 89. 1889. **Mackenzie.** A Preliminary List of Algae collected in the neighborhood of Toronto. Proceedings of Canadian Institute. III. 7: 270. 1890. **Anderson.** List of California Marine Algae, with notes. Zoe. 2: 217. 1891. **Collins.** Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 249. 1894. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 275. 1895. **Setchell.** Notes on Cyan-

ophyceae. III. Erythea 7: 54. 1899. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 16. no. 751. 1900. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora 2: 41. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 396. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 179. 1903. **Riddle.** Brush Lake Algae. Ohio Nat. 5: 268. 1905. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 614. 1905.

Plate I. fig. 3.

Plants spherical, oblong-ellipsoid or more or less angular from compression, single or associated in families of two, four, rarely eight; sheaths thick, usually lamellose, hyaline; cells 13-25, rarely 40 mic. in diameter; cell wall thin; cell contents homogeneous, pale blue-green, later becoming brownish and granular.

Arctic regions. Among Nostoc. Shores of Discovery Bay. (Dickie). **Alaska.** Distributed through a mass of *Microcystis marginata* which formed a slimy coating on a perpendicular cliff over which water was trickling. Juneau. (Saunders). Among other algae in pools of fresh water or on dripping rocks. Glacier Valley. Unalaska. (Lawson). **Canada.** High Park. Toronto, Ontario. (Mackenzie). **Maine.** Common among various algae in lagoon. Little Cranberry Isle. (Collins). **Massachusetts.** On slimy rocks and piers. Cape Ann. (Davis). On woodwork near high water mark. Everett. Medford. (Collins). On woodwork. County of Nantucket. (Collins). **Connecticut.** (Collins). **Rhode Island.** Common. (Bennett). **New York.** Pier. Stapleton, Staten Island; on rocks in brook near Silver Lake, spring and summer. (Pike). **New Jersey.** Terrestrial. On moist rocks. Frequent. (Wolle). **Ohio.** Brush Lake. Champaign County. Fall of 1902. (Riddle). **Washington.** In brackish water. Whidbey Island. (Gardner). **California.** On slimy rocks and cliffs at high water. (Anderson). In fresh, brackish and even in somewhat alkaline waters. (Setchell). **West Indies.** Among various algae. Jamaica. July 1900. (Pease and Butler). **Hawaii.** In stagnant water. Mauna Kea. Island of Hawaii. (Berggren).

Var. *fuscescens* (Kuetz.) De Toni. Richter. Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. Heft. 42. 3. 1897. De Toni. Syll. Algar. 5: 13. 1907.

Cell contents becoming dark-colored.

Greenland. Umanak. (Vanhöffen).

5. **Chroococcus schizodermaticus** West. Algae of English Lake District. Journ. Roy. Mic. Soc. 742. pl. 10. f. 61, 63. 1892. De Toni. Syll. Algar. 5: 13. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 275. pl. 16. f. 19. 1895.

Plate I. fig. 4.

Plants 21-42 mic. in diameter, somewhat globose or triangular, some-

times kidney-shaped associated in colonies of two, three or four; colonies solitary or in small groups; sheaths very thick, straw-colored or dark-colored, strongly lamellose, (lamellae 5-10), finally irregularly peeling off; cells 5.8-11 mic. in diameter; cell wall somewhat thick; cell contents granular, blue-green.

West Indies. On damp wall of dam. Sharp's River. St. Vincent. (Elliott).

6. *Chroococcus minutus* (Kuetzing) Naegeli. Gatt. Einz. Alg. 46. 1845. De Toni. Syll. Algar. 5: 14. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 20. no. 951. 1902.

Plants 6-9 mic. in diameter, 10-13 mic. in length, spherical or oblong, more or less angular, usually united in twos; sheaths somewhat orbicular, hyaline, distinct; cells 5-7 mic. in diameter, 9-10 mic. long; cell contents homogeneous or granular, pale blue-green.

Maine. Growing in high pool. Cape Rosier. July 1898. (Collins).

7. *Chroococcus multicoloratus* Wood. Fresh-Water Algae North America. 11. pl. 5. f. 6. 1872. De Toni. Syll. Algar. 5: 11. 1907.

Plate I. fig. 5.

In a mucous mass with other algae; plants 3 mic. in diameter, spherical and single, or angular, semi-spherical or irregular and associated in oblong families of from two to four (rarely eight); sheaths thick, hyaline, not lamellose; cells 1.7 mic. in diameter; cell contents mostly homogeneous, sometimes minutely granular, yellowish-green, bluish-green, yellowish, brownish, blackish, sometimes tinged with bright lake.

Pennsylvania. On wet rocks. Near Philadelphia. (Wood).

8. *Chroococcus thermophilus* Wood. Am. Journ. Sci. Arts. 122. 1869; Contr. Hist. Fresh-Water Algae North America. 12. 1872. De Toni. Syll. Algar. 5: 10. 1907.

Wolle. Fresh-Water Algae U. S. 335. 1887.

Plants subglobose or oblong, angular, single or in twos or fours, associated in families; sheaths very thick, transparent, not lamellose, homogeneous; cells 1-1.5 mic. in diameter; cell contents sometimes minutely granular, sometimes homogeneous, greenish.

California. In Nostoc colonies. In hot springs (100°-120°F.) Benton's Spring. Owen's Valley, sixty miles southwest from the town of Aurora. (Partz).

9. *Chroococcus varius* A. Braun in Rabenhorst. Die Algen Europas. no. 246, 248, 2456. 1861-78. De Toni. Syll. Algar. 5: 21. 1907.

Tilden. American Algae. Century II. no. 198. 1896; Observations on some West American Thermal Algae. Bot. Gaz. 25: 104. pl. 8. f. 21. 1898; Am. Alg. Cent. VI. no. 600. 1902. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 25. no. 1202. 1905.

Plant mass gelatinous-mucous, dull brown or olive green; plants 4-8 mic. in diameter, globose, single or in twos or fours, rarely forming larger fam-

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ilies which occur as shapeless bunches; sheaths of medium thickness, hyaline, very slightly lamellose, often pale yellow or orange in color, almost opaque; cells 2-4 mic. in diameter; cell contents pale bluish gray or bluish green, sometimes yellowish.

Massachusetts. On walls of greenhouse. Botanic Garden. Cambridge. January 1899. (Collins). **Montana.** In hot springs. Lo Lo Hot Springs. Lo Lo. September 1898. (Griffiths). **Wyoming.** On rocks near vent of geyser. Sometimes heated. Norris Geyser Basin. June 1896. In overflow from spring, temperature 41° C. Frying Pan Basin, July 1896. Yellowstone National Park. (Tilden). Forming a green coating on floor of overflow channel. Temperature 49° C. Constant Geyser, Norris Geyser Basin; in acid waters, Green Spring, between Norris Geyser Basin and Beaver Lake. Yellowstone National Park. 1897. (Weed).

Dr. Setchell is undoubtedly right in placing the Yellowstone specimens in the genus *Pleurocapsa*. (See *P. caldaria*.)

10. **Chroococcus decorticans** A. Braun. Betracht. ueber die Erschein. Verjung. in der Natur. 194. 1851. De Toni. Syll. Algar. 5: 18. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 181. 1877.

Plants 6-11 mic. in diameter, single or associated in families of two or four; sheaths distinct, lamellose, finally irregularly peeling off; cell wall solid, colorless; cell contents blue-green.

Pennsylvania. Submerged timbers. (Wolle).

11. **Chroococcus refractus** Wood. Contr. Hist. Fresh-Water Algae North America. II. pl. 5. f. 5. 1872. De Toni. Syll. Algar. 5: 20. 1907.

Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 10. 1908.

Plants 5 mic. in diameter, mostly subquadrate, very often triangular, rarely multiangular, closely associated in solid families; families often lobed; sheaths thin, scarcely perceptible, transparent; cell contents finely granular, brownish, olive-green, or yellowish, highly refractive.

Pennsylvania. Growing abundantly on wet rocks along the Reading Railroad between Manayunk and the Flat Rock tunnel. (Wood). **Iowa.** Ames. 1884. (Bessey).

12. **Chroococcus helveticus** Naegeli. Gatt. Einz. Alg. 46. pl. 1. 1849. De Toni. Syll. Algar. 5: 17. 1907.

Lagerheim. Ueber einige Algen aus Cuba, Jamaica und Puerto-Rico. Bot. Notiser. 199. 1887.

Plants 4-7.5 mic., rarely 9 mic. in diameter, spherical, associated in families of two, four or eight; sheaths spherical, gelatinous, scarcely visible; cell wall very thin, colorless; cell contents homogeneous or somewhat granular, blue-green or greenish, pale or yellowish in color.

West Indies. On *Utricularia* in stagnant water. Near Fajardo. Porto Rico. April 1885. (Sintenis).

13. *Chroococcus pallidus* Naegeli. Gatt. Einz. Alg. 46. pl. 1. f. 2. 1849. De Toni. Syll. Algar. 5: 19. 1907.

Snow. The Plankton Algae of Lake Erie. U. S. Fish Commission Bull. for 1902. 22: 392. 1903.

Plant mass mucilaginous, pale yellowish; plants 7.5-13 mic. in diameter, globose, single or in families of two, four or eight; sheaths oblong-elliptical, colorless; cells 6-11 mic. in diameter; cell walls somewhat thick, homogeneous, hyaline; cell contents finely granular, greenish, yellowish or orange, rarely bluish or blue-green.

Ohio. Put-in-Bay. Lake Erie. Summers of 1898, 1899, 1900. (Snow).

14. *Chroococcus cohaerens* (Brébisson) Naegeli. Gatt. Einz. Alg. 46. 1849. De Toni. Syll. Algar. 5: 21. 1907.

Wolle. Fresh-Water Algae U. S. 335. pl. 210. f. 42. 1887. **Webber.** The Fresh-Water Algae of the Plains. Am. Nat. 23: 1011. 1889. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 16. pl. 1. f. 1. 1894. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 275. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 15. no. 701. 1900. **Collins.** Phycological Notes of the late Isaac Holden,—II. Rhodora. 7: 235. 1905.

Plant mass green, or later becoming greenish black, gelatinous; sheaths distinct, hyaline, ellipsoid; cells 2.7-6.6 mic. in diameter, globose or oblong, in twos or fours forming colonies 7-15 mic. in diameter; cell wall thin; cell contents homogeneous or slightly granular, of a turbid, blue-green color.

United States. On damp walls, rocks, etc. (Wolle). **Maine.** On shaded cliffs. Eagle Island. Penobscot Bay. July 1892. (Collins). **Connecticut.** Among other algae, on abutment of Factory Pond dam. December. (Holden). **Nebraska.** Stagnant water. Thedford. (Webber, Saunders). **West Indies.** Amongst other algae on trees. Summit of Trois Pitons (4500 ft.). Dominica. November and December, 1892. (Elliott).

15. *Chroococcus minor* (Kuetzing) Naegeli. Gatt. Einz. Alg. 47. pl. 1 A. f. 4. 1849. De Toni. Syll. Algar. 5: 23. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 275. 1895. **Bessey, Pound and Clements.** Additions to the reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901.

Plate I. fig. 7.

Plant mass mucous-gelatinous, dull blue-green or olive green; 3-4 mic. in diameter, rotund, single or in pairs, angular; sheaths mucous, scarcely visible; cell walls very thin, hyaline; cell contents homogeneous, usually pale bluish-green.

Nebraska. In aquarium. Lincoln. (Bessey). **West Indies.** On damp wall of dam. Sharp's River. St. Vincent; on trees. Summit of Trois Pitons (4500 ft.). Dominica. (Elliott).

Forma *minima* W. and G. S. West. loc. cit. 275. pl. 16. f. 18. 1895.

Cells 1-1.9 mic. in diameter; families 10-23 mic. in diameter.

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West Indies. With the type from the above-named localities. On lime trees. Shanford Estate. Dominica. (Elliott).

16. **Chroococcus membraninus** (Meneghini) Naegeli. Gatt. Einz. Alg. 46. 1849. De Toni. Syll. Algar. 5: 23. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 25. no. 1201. 1905.

Plant mass somewhat membranaceous, mucous, lead-colored to green, becoming blackish; plants 3-8 mic. in diameter, globose or subglobose, single, or associated in families of twos or fours; families 8-26 mic. in diameter; sheaths thick, mucous, hyaline; cell walls thick, colorless; cell contents minutely granular, blue or blue-green.

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California. Forming a zone, yellowish red just above, and blue-green just below, the edge of the water, very low, in "The Lagoon," Niles, Alameda County. November 1898. (Setchell).

17. **Chroococcus limneticus** Lemmermann. Beiträge zur Kenntniss der Planktonalgen. Bot. Centralb. 76: 153. 1898. De Toni. Syll. Algar. 5: 16. 1907.

Snow. The Plankton Algae of Lake Erie. U. S. Fish Commission Bull. for 1902. 22: 392. 1903.

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Plate I. fig. 8.

Plant mass floating free; tegument wide; plants 8-13 mic. in diameter, much crowded, before division globose, after division hemispherical; sheaths hyaline, distinct, lamellose; cell contents greenish or pale blue-green.

Ohio. Put-in-Bay. Lake Erie. Summers of 1898, 1899, 1900. (Snow).

18. **Chroococcus purpureus** Snow. The Plankton Algae of Lake Erie. U. S. Fish Commission Bull. for 1902. 22: 388. 390. 1903.

Plate I. fig. 9.

Plant mass gelatinous, floating free; tegument wide; plants 13 mic. in diameter, spherical, or just before division elongated, usually arranged two by two in colonies of four or eight; sheaths thin; cell contents grayish-purple, changing to brown under unfavorable conditions.

Ohio. Common in the plankton of Lake Erie. Put-in-Bay. (Snow).

Genus **SYNECHOCYSTIS** Sauvageau.
Bull. Soc. Bot. de France. 39: cxv. 1892.

Plants always globose; sheaths none; cell walls thin not diffuent; cell contents blue-green; reproduction by division of the cells in one direction only.

19. **Synechocystis aquatilis** Sauvageau. Sur les Algues d'eau douce récoltées en Algérie pendant la session de la Société Botanique en 1892. Bull. Soc. Bot. de France. 39: cxvi. pl. 6. f. 2. 1892. De Toni. Syll. Algar. 5: 26. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 25. no. 1206. 1905.

Plate I. fig. 10.

Submerged; plants 5-6 mic. in diameter, single or in pairs; cell walls hvaline, very thin; cell contents pale blue-green.

California. On the outside of a dripping water tank. Berkeley. April 1904. (Gardner).

Genus **SYNECHOCOCCUS** Naegeli.

Gatt. Einz. Alg. 56. pl. 1. 1849.

Plants oblong, cylindrical or ellipsoidal, usually single, occasionally forming families of two or four united in a row or chain; sheaths none; cell walls thin; cell contents blue-green, sometimes yellowish, pinkish or pale orange; reproduction by division of the cells in one direction only.

I Cell contents blue-green.

1 Cells 7-15 mic. in diameter, 14-26 mic. in length **S. aeruginosus**

2 Cells 2 mic. in diameter, 4-6 mic. in length **S. racemosus**

3 Growing in hot salt water; cells 3 mic. in diameter, 6 mic. in length
S. curtus

20. **Synechococcus aeruginosus** Naegeli. Gatt. Einz. Alg. 56. pl. 1 E. f. 1. 1849. De Toni. Syll. Algar. 5: 27. 1907.

Farlow. Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Tilden.** Am. Alg. Cent. II. no. 195. 1896; On some Algal Stalactites of the Yellowstone National Park. Bot. Gaz. 24: 198. pl. 8. f. 6. 1897. Observations on some West American Thermal Algae. Bot. Gaz. 25: 103. 1898. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904.

Plate I. fig. 11.

Plants 7-15 mic. in diameter, 14-26 mic. in length, oblong or somewhat cylindrical, obtusely rotund at both ends, single or in pairs; cell contents homogeneous, light or pale blue-green.

Greenland. (Boergesen). **New Hampshire.** Moist rocks at the Flume. Lake Willoughby. (Farlow). **Wyoming.** One of the three species of Blue-green algae which formed algal "stalactites." Growing in a small cave made by the cone of a geyser. Valley of the Nez Perces Creek. Lower Geyser Basin. Yellowstone National Park. June 1896. (Tilden).

21. **Synechococcus racemosus** Wolle. Fresh-Water Algae. V. Bull. Torr. Bot. Club. 8: 37. 1881. De Toni. Syll. Algar. 5: 28. 1907.

Plant mass amorphous, blue-green; plants 2 mic. in diameter, two to four times longer than broad, oblong-cylindrical, with rounded ends, often showing a regular vertical arrangement, densely aggregated; cell contents homogeneous, pale blue-green.

Pennsylvania. Glass sides of aquarium. Bethlehem. (Wolle).

22. **Synechococcus curtus** Setchell in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 28. no. 1351. 1907.

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Plants 3 mic. in diameter, 6 mic. long just before dividing, slightly elongated, single or united by strands of transparent jelly; cell walls very thin, scarcely visible; cell contents pale bluish-green.

California. Floating in myriads in hot salt water, near Key Route power house. Oakland. September 1905. (Gardner).

✓ Genus **CHROOTHECE** Hansgirg.
Oesterr. Bot. Zeit. 34: pl. 1. 1884.

- I. Plant mass somewhat gelatinous, dark-yellowish; plants cylindrical or oblong-conical, with rotund ends, single or in pairs; sheaths wide, lamellose, hyaline, increasing greatly in thickness at one pole; cell contents distinctly granular, bright blue-green or orange-yellow; reproduction by division of the cells in one direction only.

I Plants 18-24 mic. in diameter

C. richteriana

II Plants 1.5 mic. in diameter

C. cryptarum

III Plants 11-12.5 mic. in diameter

C. monococca

23. **Chroothece richteriana** Hansgirg. Bot. Notiser. 128. 1884; Prodrömus der Algenflora von Böhmen. 2: 134. f. 45. 1892. De Toni. Syll. Algar. 5: 29. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 702. 1900.
Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901.

Plate I. fig. 12.

Plant mass somewhat gelatinous, thick, more or less expanded, blue-green or yellowish, becoming darker; plants 18-24 mic. in diameter, once to twice as long as wide, single or in pairs; sheaths up to 6 mic. in diameter, somewhat colorless.

Bermudas. On rocks. The Flats. Bermuda. January 1900. (Farlow).
West Indies. Among other algae, in small quantity. Montego Bay. (Pease and Butler).

24. **Chroothece ? cryptarum** Farlow in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 16. no. 752. 1900. De Toni. Syll. Algar. 5: 30. 1907.

Plant mass irregular, gelatinous, widely expanded, of a pale blue-green or dirty yellow color; plants 1.5 mic. in diameter, 3 mic. in length, oblong or rod-shaped; sheaths gelatinous, colorless, becoming lamellate and developing below into densely branching *Urococcus*-like stalks, 7-9 mic. in diameter, 25-50 mic. in length; cell contents blue-green, without definitely shaped chromatophore; cell division usually in one, occasionally in two directions.

Bermudas. On calcareous rocks in caves by the seashore. Bermuda. January 1900. (Farlow).

25. **Chroothece monococca** (Kuetzing) Hansgirg. Prodrömus der Algenflora von Böhmen. 2: 134. 1892. De Toni. Syll. Algar. 5: 30. 1907.

Plant mass amorphous, gelatinous, blue-green; families 15-20 mic. in diameter; plants 11-12.5 mic. in diameter, up to twice as long as broad, ellip-

soid or oblong, obtusely rounded on both ends, single or in pairs; cells 4-6 mic. in diameter; cell contents blue-green.

Var. *mellea* (Kuetz.) Hansgirg. loc. cit. 135. 1892. De Toni. loc. cit. 31.

Wolle. Fresh-Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877. (*Gloeocapsa mellea* Kuetz.).

Cell contents yellowish-red or yellowish-brown.

Colorado. (Wolle).

Genus **GLOEOCAPSA** Kuetzing. Phyc. Gen. 174. 1843.

Plants spherical (or immediately after division oblong), either single or a number associated in families; each cell enclosed in a vesicle-like, strongly thickened, usually distinctly lamellose sheath; sheaths often very thick, colorless or colored, usually lamellose; lamellae often peeling off; cell contents blue-green, bluish, steel-blue, reddish, yellowish, etc.; reproduction by division of the cells alternately in three directions.

When a cell divides into two daughter-cells, each one secretes a sheath about itself, the two still being enclosed by the sheath of the mother-cell. As division goes on, the sheath of the original cell remains enveloping the entire family, and in fact all the sheaths remain in existence. Therefore, there will always be one less than twice as many sheaths as there are cells in the family (in a family of four cells there will be seven sheaths; in a family of sixteen cells there will be thirty-one sheaths). Later generations of cells are smaller than the first ones.

I Sheaths colorless

I Sheaths lamellose

(1) Sheaths wide

A Plant mass steel blue, green, olive or dull yellow; plants 7-8 mic. in diameter; sheaths very wide, indistinctly lamellose; cells 3-5 mic. in diameter **G. granosa**

B Plant mass dull green or olive; plants 3-4.5 mic. in diameter; sheaths very thick, with numerous concentric lamellae **G. polydermatica**

C Plant mass green; plants 7-15 mic. in diameter; sheaths very thick, more or less distinctly lamellose; cells 2.2-3.4 mic. in diameter **G. fenestralis**

D Plant mass somewhat olivaceous; plants 6-17 mic. in diameter; sheaths thick; cells 3.7-6 mic. in diameter **G. arenaria**

(2) Sheaths narrow

A Plant mass pale yellow becoming greenish; growing in hot water; plants 19-39 mic. in diameter; cells 3-6 mic. in diameter **G. montana**

B Plant mass mucilaginous, dull green or gray becoming blackish, or red becoming brownish; plants 7-11 mic. in diameter; cells 3-4.5 mic. in diameter **G. quaternata**

C Plant mass a calcareous crust, light gray or green; plants 6-9 mic. in diameter **G. calcarea**

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- D Plant mass gelatinous, brownish, growing on *Zostera*; sheaths numerous, distinct; cells 9-11 mic. in diameter, 19-26 mic. in length
G. zostericola
- 2 Sheaths sometimes lamellose
- (1) Plant mass blue-green or greenish; sheaths not distinctly lamellose
- A Free-floating; cells .75-2.8 mic. in diameter *G. punctata*
- B On wet rocks; plants 4-8 mic. in diameter; cells 2-3 mic. in diameter
G. aeruginosa
- (2) Plant mass olive or green; plants 6.2-10 mic. in diameter; sheaths narrow, lamellose when old; cells 2.5 mic. in diameter
G. gelatinosa
- (3) Plant mass dull olive; plants 7-11 mic. in diameter; sheaths thick, not at all or scarcely lamellose; cells 3-6 mic. in diameter
G. conglomerata
- 3 Sheaths not lamellose
- (1) Plant mass flesh-colored to yellowish; plants 2.5-5.5 mic. in diameter; cell contents flesh-colored to honey-colored
G. mellea
- (2) Plant mass black; plants 9-14 mic. in diameter; cells 3.5-4.5 mic. in diameter; cell contents pale blue-green
G. atrata
- II Sheaths yellowish or brownish
- 1 Sheaths lamellose
- (1) Plant mass dull olive to brownish-green; sheaths colorless or yellowish
G. muralis
- (2) Plant mass grayish-brown to black; sheaths very thick, yellowish or orange, becoming darker
G. rupestris
- 2 Sheaths sometimes lamellose
- (1) Plants 4.5-5.5 mic. in diameter; sheaths usually not lamellose; cells 1.5-2 mic. in diameter
G. fusco-lutea
- (2) Plants 12 mic. in diameter; sheaths homogeneous or lamellose; cells 3-4.5 mic. in diameter
G. sparsa
- (3) Colonies subglobose; sheaths somewhat lamellose; cells 9-15 mic. in diameter
G. gigas
- 3 Sheaths not lamellose; plant mass olive-green; plants 5-8 mic. in diameter
G. crepidinum
- III Sheaths violet, purple or red.
- 1 Sheaths lamellose
- (1) Plant mass purple, sometimes becoming black
- A Sheaths deep purple or copper-brown; plants 6-12 mic. in diameter
G. magma
- B Sheaths violet or reddish-purple; plants 7.5-12 mic. in diameter; cells 2-4.5 mic. in diameter
G. janthina

- C Sheaths very thick, opaque, intensely lamellose; plants 10-17 mic. in diameter; cells 4-7 mic. in diameter *G. ralfsiana*
- 2 Sheaths sometimes lamellose; plant mass colorless or dark purple, growing in hot water; plants 6-7.8 mic. in diameter; cells 1-2.6 mic. in diameter *G. thermalis*
- 3 Sheaths not lamellose
- (1) Plant mass violet becoming gray or black
- A Plants 4-8 mic. in diameter; sheaths violet, thick, often opaque; cells 1.8-2.5 mic. in diameter *G. ambigua*
- B Plants 10-17 mic. in diameter; sheaths violet or rose-colored; cells 3.5 mic. in diameter *G. violacea*
- (2) Plant mass reddish-orange, dark red or black
- A Plants 11-24 mic. in diameter; sheaths very thick, soon peeling off *G. dubia*
- B Sheaths intensely blood-red, very wide; cells 3.5-9 mic. in diameter *G. sanguinea*
26. *Gloeocapsa granosa* (Berkeley) Kuetzing. Tab. Phyc. 1: pl. 36. f. VIII. 1845-1849. De Toni. Syll. Algar. 5: 53. 1907.
- Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877. (*Gloeotheca granosa* Rabenh.).

Plate I. fig. 13.

Plant mass compact, gelatinous, somewhat cartilaginous, granular, steel blue, green, olive, or dull yellow, more or less spreading; plants 7-8 mic. in diameter, globose or oblong, usually two or four in families 18-60 mic. in diameter; sheaths very wide, many times exceeding the lumen of the cell, indistinctly lamellose, colorless or nearly so; cells 3-5 mic. in diameter; cell contents homogeneous or granular, pale blue-green.

Pennsylvania. Wet rocks. (Wolle).

27. *Gloeocapsa polydermatica* Kuetzing. Tab. Phyc. 1: pl. 20. 1845-1849. De Toni. Syll. Algar. 5: 51. 1907.

Wolle. Fresh-Water Algae U. S. 331. pl. 210. f. 29-31. 1887. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 126. 1896. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 179. 1903.

Plate I. fig. 14.

Plant mass gelatinous, more or less compact, dull green or dusky olive; plants 3-4.5 mic. in diameter, spherical; sheaths very thick, hyaline, lamellose, with numerous concentric firm lamellae; cell contents somewhat homogeneous, blue-green or green.

Alaska. On dripping rocks. Near Iliuliuk, Unalaska. (Setchell and Lawson). **Massachusetts.** On dripping rocks. Cascade, Middlesex Fells.

(Collins). **Pennsylvania.** (Wolle). **Hawaii.** Volcano Mauna Kea, Island of Hawaii. (Berggren).

28. *Gloeocapsa fenestralis* Kuetzing. Phyc. Gen. 173. 1843. De Toni. Syll. Algar. 5: 53. 1907.

Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903.

Plate I. fig. 15.

Plant mass thin, mucous, expanded, irregular, green; plants 7-15 mic. in diameter, spherical or oblong, associated in families 16-48 mic. in diameter; sheaths very thick, colorless, more or less distinctly lamellose, often quickly peeling off; cells 2.2-3.4 mic. in diameter; cell contents homogeneous or granular, pale blue-green.

Ohio. Put-in-Bay, Lake Erie. (Snow).

29. *Gloeocapsa arenaria* (Hassall) Rabenhorst. Fl. Eur. Algar. 2: 39. 1865. De Toni. Syll. Algar. 5: 54. 1907.

West. The Freshwater Algae of Maine. Journ. of Bot. 27: 207. 1889. **Bessey.** Miscellaneous Additions to the Flora of the State. Bot. Surv. Nebraska. 2: 46. 1893. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 16. pl. 1. f. 3. 1894. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1909.

Plate I. fig. 16.

Plant mass mucous, adherent, olivaceous; plants 6-17 mic. in diameter, spherical, associated in families up to 43 mic. in diameter; sheaths oblong or somewhat spherical, thick, colorless, lamellose, soon peeling off; cells 3.7-6 mic. in diameter; cell contents distinctly granular, blue-green or green, becoming darker.

Maine. (West). **Minnesota.** Near Minneapolis. (Lilley). **Iowa.** Abundant on flower pots in greenhouse. Ames. 1904. (Buchanan). Forming thin blue-green coating on damp stones. Grinnell. 1905. (Fink). **Nebraska.** On flower pots in greenhouse. Lincoln. (Saunders).

30. *Gloeocapsa montana* Kuetzing. Phyc. Gen. 173. no. 1. 1843. De Toni. Syll. Algar. 5: 51. 1907.

Tilden. American Algae. Cent. II. no. 197. 1896. (*G. l. montana caldarii* Sur.).

Plate I. fig. 17.

Plant mass amorphous, somewhat thick, mucous, pale yellow, becoming greenish; plants 19-39 mic. in diameter, spherical or somewhat spherical, usually solitary; sheaths lamellose, colorless, sometimes peeling off; cells 3-6 mic. in diameter; cell contents somewhat opaque, homogeneous, or slightly granular, pale blue-green.

Wyoming. In warm overflow water. Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden).

31. *Gloeocapsa quarternata* (Brébisson) Kuetzing. Tab. Phyc. 1: pl. 20. f. 1. 1845-1849. De Toni. Syll. Algar. 5: 52. 1907.

Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901.
Tilden. American Algae. Cent. V. no. 499. 1901; Collection of Algae from the Hawaiian Islands. Haw. Almanac⁴ and Annual for 1902. 113. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 168. 1902.

Plate I. fig. 18.

Plant mass mucous, gelatinous, more or less spread out, dull, green becoming blackish, or red becoming brownish; plants 7-11 mic. in diameter, usually spherical, solitary or in twos or fours; sheaths narrow, lamellose, colorless, rotund or oblong; cells 3-4.5 mic. in diameter; cell contents homogeneous or slightly granular, blue-green or greenish.

West Indies. Roadside. Bath. Jamaica. July 1900. (Pease and Butler).
Hawaii. Forming a gray-green, mucilaginous coating, on wet cliffs. South of Laupahoehoe, Hawaii. July 1900. (Tilden).

32. *Gloeocapsa calcarea* Tilden. List of fresh-water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 29. 1898.
De Toni. Syll. Algar. 5: 40. 1907.

Tilden. American Algae. Cent. III. no. 299. 1898.

Plant mass forming a calcareous crust, light gray to light blue-green in color, 2-3 mm. in thickness; plants 6-9 mic. in diameter; families 25-50 mic. in diameter, composed of from 4-16 plants; sheaths colorless, somewhat thin; cell contents granular, blue-green.

Wisconsin. Forming a calcareous crust (with other lime-secreting forms) on boards where spring water from trough drips down constantly. Osceola. September 1897. (Tilden).

33. *Gloeocapsa zostericola* Farlow. Notes on New England Algae. Bull. Torr. Bot. Club. 9: 68. 1882. De Toni. Syll. Algar. 5: 57. 1907.

Plant mass amorphous, gelatinous, brownish; families 40-100 mic. in diameter; sheaths numerous, distinct (lamellose?); cells 9-11 mic. in diameter, 19-26 mic. in length, flattened-hemispherical, concave on the inner surface, in families of twos or fours.

Massachusetts. On *Zostera* mixed with *Calothrix*. Wood's Hole. August 1881. (Farlow).

34. *Gloeocapsa punctata* Naegeli. Gatt. Einz. Alg. 51. pl. I F. f. 6. 1849.
Snow. The Plankton Algae of Lake Erie, etc. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903.

Plant mass mucous, blue-green or gray; families 23 mic. wide, containing 2-16 plants; sheaths thick, not distinctly lamellose; inner lamellae diffuent; cells .75-2.8 mic. in diameter, spherical; cell contents homogeneous, pale blue-green.

Ohio. Put-in-Bay, Lake Erie. (Snow.)

35. *Gloeocapsa aeruginosa* (Carmichael) Kuetzing. Tab. Phyc. 1: pl. 21. f. 2. 1845-1849. De Toni. Syll. Algar. 5: 55. 1907.

Plate I. fig. 19.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877; Fresh-Water Algæ U. S. 331. pl. 210. f. 27, 28. 1887. Moebius. Ueber einige in Portorico gesammelte Süßwasser- und Luft-Algen. Hedwigia. 27: 248. 1888.

Plant mass crustaceous, grumose or cartilaginous-mucous, blue-green or gray-green; families 16-50 mic. in diameter; plants 4-8 mic. in diameter, spherical; sheaths thick, colorless, indistinctly lamellose; outer lamellae often sinuate, angular; cells 2-3 mic. in diameter; cell contents homogeneous, blue-green.

Greenland. (Börgesen). New York. Niagara. (Wolle). West Indies. Forming a dark green layer on stone in cave. "El Convento", near Penuelas, Porto Rico. (Sintenis). Porto Rico. (Benecke).

36. *Gloeocapsa gelatinosa* Kuetzing. Phyc. Gen. 174. 1843. De Toni. Syll. Algar. 5: 54. 1907.

Plate I. fig. 20.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877. West and West. A further contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 289. 1898-1900.

Plant mass lubricous, bullose, olive or green, inundated; plants 6.2-10 mic. in diameter, globose-oblong, associated in families about 25 mic. in diameter; sheaths rather narrow, colorless, lamellose when old; lamellae permanent; cells 2.5 mic. in diameter; cell contents homogeneous, blue-green.

United States. (Wolle). West Indies. On banks. Morne Micotrin, Dominica. (Elliott).

37. *Gloeocapsa conglomerata* Kuetzing. Tab. Phyc. 1: 16. pl. 20. f. 8. 1845-1849. De Toni. Syll. Algar. 5: 56. 1907.

Plate I. fig. 21.

Plant mass gelatinous, somewhat granular, expanded, dull olive-green; plants 7-11 mic. in diameter, spherical, aggregated, associated in families 22-45 mic. in diameter; sheaths thick, colorless, not at all or scarcely lamellose; cells 3-6 mic. in diameter; cell contents blue-green or green, becoming brownish.

Colorado. On *Cladophora*. (Porter, Wolle).

38. *Gloeocapsa mellea* Kuetzing. Tab. Phyc. 1: pl. 23. f. V. 1845-1849. De Toni. Syll. Algar. 5: 46. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877.

Plant mass soft, crustaceous, pale flesh-colored to yellowish; families 10-22 mic. in diameter; plants 2.5-5.5 mic. in diameter, spherical or angular, usually arranged in globose or oblong families of two or four; sheaths

hyaline, colorless, somewhat homogeneous; cell contents flesh-colored to honey-colored.

Colorado. On walls and bare earth, often mixed with other algae. (Wolle).

39. *Gloeocapsa atrata* (Turpin) Kuetzing. Tab. Phyc. 1: pl. 21. f. 4. 1845-1849. De Toni. Syll. Algar. 5: 57. 1907.

Plate I. fig. 22.

Plant mass crustaceous, mucous, black; plants 9-14 mic. in diameter, spherical; sheaths very thick, hyaline, or pale blue, homogeneous, two or three times as wide as lumen of cell; cells 3.5-4.5 mic. in diameter; cell contents somewhat granular, pale blue-green.

Alaska. (Setchell).

40. *Gloeocapsa muralis* Kuetzing. Tab. Phyc. 1: pl. 21. f. 1. 1845-1849. De Toni. Syll. Algar. 5: 52. 1907.

Plate I. fig. 23.

Plant mass more or less expanded, delicate, gelatinous, dull olive to brownish-green; plants 13-26 mic. in diameter, usually ellipsoid or oblong; sheaths spherical or elliptical, hyaline, colorless or yellowish, usually indistinctly lamellose; cells 5-8 mic. in diameter; cell contents somewhat granular, blue-green.

West Indies. St. Vincent. (West).

41. *Gloeocapsa rupestris* Kuetzing. Tab. Phyc. 1: 17. pl. 22. f. 2. 1845-1849. De Toni. Syll. Algar. 5: 46. 1907.

Tilden. American Algae. Cent. VI. no. 599. 1902.

Plate I. fig. 24.

Plant mass grayish-brown to black, crustaceous, somewhat hard; plants spherical, associated in families 15-75 mic. wide; sheaths very thick, lamellose, yellowish or orange becoming darker; cells 6-9 mic. in diameter; cell contents granular, blue-green.

Greenland. (Boergesen). **New Jersey.** (Wolle). **Minnesota.** On moist wall growing on lime encrusted moss and on disintegrated limestone. In stone quarry. Near campus, University of Minnesota, Minneapolis. November 1901. (Lilley).

42. *Gloeocapsa fusco-lutea* (Naegeli) Kuetzing. Spec. Algar. 224. 1849. De Toni. Syll. Algar. 5: 47. 1907.

Plant mass crustaceous, becoming black; families 50 mic. in diameter, spherical or oval; plants 4.5-5.5 mic. in diameter, globose; sheaths yellow or yellowish-brown, usually not lamellose; cells 1.5-2 mic. in diameter; cell contents blue-green becoming pale.

North America. (Setchell).

43. *Gloeocapsa sparsa* Wood. Contr. Hist. Fresh-Water Algae North America. 13. 1872. De Toni. Syll. Algar. 5: 45. 1907.

Plate I. fig. 25.

Plant mass mucous; plants 12 mic. in diameter, associated in families of from two to eight; cells 3-4.5 mic. in diameter, spherical, oval or oblong; sheaths having firm inner layer, homogeneous or lamellose, yellowish-brown, rarely colorless, outer layer homogeneous or lamellose, colorless or nearly so (generally scarcely visible); cell contents homogeneous.

Pennsylvania. Forming, with other algae, a rather firm, grumous or gelatinous coating of a light brown color, growing on rocks. Fairmount Water Works, near Philadelphia. (Wood).

44. *Gloeocapsa gigas* W. and G. S. West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 276. pl. 16. f. 11-13. 1895. De Toni. Syll. Algar. 5: 47. 1907.

Plate I. fig. 26, 27.

Colonies subglobose, solitary or somewhat aggregated, consisting of from four to thirty-six cells; colonial tegument subglobose, hard, often somewhat rugose on surface, yellowish or brownish; sheaths indistinct, few, pale yellowish; cells 9-15 mic. in diameter, subglobose or oblong; cell walls smooth or finely granular; cell contents granular, blue-green.

West Indies. On damp wall of dam. St. Vincent. (Elliott).

45. *Gloeocapsa crepidinum* (Rabenhorst) Thuret. Notes Algologiques. 1: 2. pl. 1. f. 1-3. 1876. De Toni. Syll. Algar. 5: 44. 1907.

Farlow. Marine Algae of New England. 27. pl. 1. f. 1. 1881. **Collins.** Algae of Middlesex County. 16. 1888; Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 309. 1888. **Bennett.** Plants of Rhode Island. 95. 1888. **Martindale.** Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 89. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 611. 1889. **Anderson.** List of California Marine Algae, with notes. Zoe. 2: 217. 1891. **Collins.** Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 249. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 8. no. 351. 1897. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 24. no. 1151. 1904. **Collins.** Phycological Notes of the late Isaac Holden,—I. Rhodora. 7: 172. 1905.

Plate I. fig. 28.

Plant mass gelatinous, somewhat soft, olive-green (becoming black when dried); plants 5-8 mic. in diameter, solitary or in twos or fours; sheaths yellowish-brown, not lamellose; cells 4-7 mic. in diameter.

Maine. Eastport. (Farlow.) On old logs in a salt marsh. Eagle Island, Penobscot Bay. July 1896. (Collins). Common on rocks, etc. near high-water mark. (Collins). **Massachusetts.** Gloucester. (Farlow). On wood-work near high-water mark. Everett; Medford. (Collins). **Rhode Island.** Newport. (Farlow). **Connecticut.** On stonework; on wharf logs. Stratford Shoals. May, September. (Holden). **New York.** Staten Island. (Pike). **New Jersey.** On wharves. Atlantic City. (Morse, Martindale).

California. On wharves at high water. On northern and middle coasts. (Anderson). Forming gelatinous masses on logs floating in salt water. Alameda. September 1903. (Osterhout, Gardner).

46. *Gloeocapsa magma* (Brébisson) Kuetzing. Tab. Phyc. 1: 17. pl. 22. f. 1. 1845-1849. De Toni. Syll. Algar. 5: 35. 1907.

Dickie. Algae. in Hooker. An account of the plants collected by Dr. Walker in Greenland and Arctic America during the Expedition of Sir Francis M'Clintock, R. N., in the Yacht "Fox", 21 June 1860. Journ. Linn. Soc. Bot. 5: 86. 1861. (*Sorospora montana* Harv.); Notes on a collection of Algae procured in Cumberland Sound by Mr. James Taylor, and remarks on Arctic species in general. Journ. Linn. Soc. Bot. 9: 242. 1867. **Nordstedt.** De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 3. 1878. **Dickie.** On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 9. 1880. **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Wolle.** Fresh-Water Algae U. S. 331. pl. 210. f. 26-31. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 612. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 4. no. 151. 1896. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 126. 1896. **Richter.** Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. Heft. 42. 3. 1897. **Collins.** Algae of the Flume. Rhodora. 6: 229. 1904. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 614. 1905. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate I. fig. 29.

Plant mass grumous, crustaceous, coppery-purple, becoming black when dried; families 30-70, rarely 300 mic. in diameter; plants 6-12 mic. in diameter, spherical; sheaths lamellose, deep purple or copper-brown, usually not pellucid, the external layer very broad, globose, paler or colorless, soon diffuent; cells 4.5-7 mic. in diameter, spherical; cell contents blue-green, granular, often becoming brownish.

Dominion of Canada. Fresh water. Port Kennedy. (Walker). Cumberland Sound, Davis Strait. (Taylor). Marshes, Floeberg Beach, 82° 27' N. (Dickie). **Greenland.** Fresh water brook. Karaik, near south end of Nunataks, Umanakdistrikt. 1892, 1893. (Vanhöffen). **United States.** Forming a purplish-brown, grumous thallus. (Wolle). **New Hampshire.** Common on wet stones at the top of Cabot Mountain, Shelburne. (Farlow). One of the species composing the brown coating of the wall of "The Flume." September 1904. (Collins). **Massachusetts.** Forming a dark purplish slimy coating on perpendicular wet rocks. Middlesex Fells. June 1895. (Collins). **New Jersey.** On shaded rocks. (Wolle). **Minnesota.** On rocks. Taylor's Falls. July 1896. (Fink). **Iowa.** On granitic boulders. Fayette. (Fink). **Hawaii.** Mauna Kea. Island of Hawaii; on stones. Island of Oahu. (Berggren).

Var. itzigsohnii (Bornet) Hansgirg. Prodrum der Algenflora von Böhmen. 2: 147. 1892. De Toni. Syll. Algar. 5: 36. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877. (G. itzigsohnii Bornet).

Plant mass brownish-red; families 15-60 mic. in diameter; sheaths conspicuously lamellose, the inner layers coppery-red, the outer ones paler or colorless; cells 4-5 mic. in diameter, globose or ellipsoid; cell contents greenish.

Pennsylvania. Shaded rocks. (Wolle).

47. *Gloeocapsa janthina* Naegeli. Gatt. Einz. Alg. 51. pl. 1 F. f. 5. 1849. De Toni. Syll. Algar. 5: 40. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 25. no. 1205. 1905.

Plant mass crustaceous, black; plants 7.5-12 mic. in diameter, spherical; sheaths violet or reddish-violet, outer layers paler, sometimes peeling off; cells 2-4.5 mic. in diameter; cell contents pale blue-green.

Greenland. (Boergesen). Massachusetts. On dripping masonry under railroad bridge. Melrose. August 1902. (Collins). New York. Cliffs. Niagara. (Wolle).

48. *Gloeocapsa ralfsiana* (Harvey) Kuetzing. Tab. Phyc. 1: pl. 23. 1845-1849. De Toni. Syll. Algar. 5: 37. 1907.

Plate I. fig. 30.

Plant mass gelatinous, compact, dull dusky purple; plants 10-17 mic. in diameter, associated in families of from 2-8 cells; sheaths very thick, opaque, intensely purple, the outer layers very wide, nearly colorless, usually angular from pressure, sometimes diffuent; cell contents granular, pale blue-green.

Greenland. In *Parmelia saxatilis*. (Wulfschlaegel).

49. *Gloeocapsa thermalis* Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 614. pl. 7. f. 12-18. 1905. De Toni. Syll. Algar. 5: 36. 1907.

Plate I. fig. 31.

Plant mass mucous, hyaline or dark-purple; families 2-8 celled, usually oblong, 8-11 mic. in length; plants, including sheath, 6-7.8 mic. in diameter, globose, often solitary; sheaths hyaline or dark purple, granular; cells 1-2.6 mic. in diameter, globose, pale blue-green.

Hawaii. In hot water. Volcano of Mauna Kea. Island of Hawaii. 1896-97. (Schauinsland).

50. *Gloeocapsa ambigua* Naegeli in Kuetz. Spec. Algar. 220. 1849. De Toni. Syll. Algar. 5: 41. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 179. 1903. (*G. ambigua* f. *fuscolutea* Naeg.)

Plant mass crustaceous, violet becoming black; families about 62 mic. in diameter; plants 4-8 mic. in diameter, spherical; sheaths violet, usually opaque not lamellose; cells 1.8-2.5 mic. in diameter; cell contents finely granular, blue-green.

Alaska. In mountain stream. Orca. (Jepson).

51. *Gloeocapsa violacea* (Corda) Rabenhorst. Fl. Eur. Algar. 2: 41. 1865.
De Toni. Syll. Algar. 5: 39. 1907.

Tilden. American Algae. Cent. II. no. 196. 1896; On some Algal stalactites of the Yellowstone National Park. Bot. Gaz. 24: 198. pl. 8. f. 5. 1897; Observations on some West American Thermal Algae. Bot. Gaz. 25: 103. 1898. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 12. no. 551. 1899. **Collins.** Phycological Notes of the late Isaac Holden,—II. Rhodora. 7: 235. 1905.

Plate I. fig. 32.

Plant mass thin, mucous or gelatinous, dull violet or grayish-violet; families about 100 mic. in diameter; plants 10-17 mic. in diameter, globose; sheaths not lamellose, violet or rose-colored; outer layers colorless, hyaline, very wide; cells 3.5 mic. in diameter; cell contents granular, blue-green.

Alaska. (Setchell). **Connecticut.** "On vertical face of moist limestone, east side of road and a few rods from it, a mile or so from the station on the road to Bull's Bridge." Gaylordsville. October 1898. (Holden). **Wyoming.** Valley of the Nez Perces Creek, Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden).

52. *Gloeocapsa dubia* Wartmann in Rabenhorst. Die Algen Europas. no. 1092. Kirchner. Algen. Kryptogamen-Flora von Schlesien. 256. 1878.
De Toni. Syll. Algar. 5: 34. 1907.

Farlow. Notes on the Cryptogamic Flora of the White Mountains. Apalachia. 3: 236. 1883.

Plant mass either grumous or widely expanded, gelatinous, firm, reddish-orange, when dried generally of a dull greenish color; plants 11-24 mic. in diameter, spherical or oblong, densely aggregated, usually associated in families of twos or fours; sheaths very thick, usually twice the diameter of the cell, not lamellose, soon peeling off; cell contents granular, brownish, when dried homogeneous and bluish-green.

Greenland. (Boergesen). **New Hampshire.** On rocks. Flume; Cabot Mountain, Shelburne. (Farlow).

53. *Gloeocapsa sanguinea* (Agardh) Kuetzing. Phyc. Gen. 174. 1843. De Toni. Syll. Algar. 5: 36. 1907.

Plant mass thin, gelatinous, extended, blood red, or thicker, somewhat crustaceous and black; families 25-50, rarely 140 mic. in diameter; sheaths very wide, not lamellose, intensely blood red, inner layers pale red, outer layers colorless or nearly colorless; cells 3.5-9 mic. in diameter; cell contents granular, pale blue-green.

Greenland. (Boergesen).

Genus **ENTOPHYSALIS** Kuetz. Phyc. Gen. 177. 1843.

Plant mass globose, cartilaginous, including numerous, more or less. confluent small families of cells; cells spherical, each surrounded by an elliptical sheath, associated in families.

- I Plant mass crustaceous; cells 2-5 mic. in diameter *E. granulosa*
 II Plant mass mucous; cells 4-6 mic. in diameter *E. magnoliae*

54. *Entophysalis granulosa* Kuetzing. Phyc. Gen. 177. pl. XVIII. f. 5. 1843.
 De Toni. Syll. Algar. 5: 58. 1907.

Collins. Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 309. 1888. **Martindale.** Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 89. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 611. 1889. **Collins.** Notes on New England Marine Algae,—VI. Bull. Torr. Bot. Club. 23: 1. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 4. no. 152. 1896. **Collins.** Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 41. 1900; Phycological Notes of the late Isaac Holden,—I. Rhodora. 7: 172. 1905.

Plate I. fig. 33.

Plant mass crustaceous, up to 1 mm. in thickness, granular and warted, cartilaginous to fragile, brownish or black; cells 2-5 mic. in diameter; sheaths very thick, lamellose, brownish.

Maine. Forming an incrustation on edge of rocky tide pool, at extreme high water mark. Cape Rosier. July 1895. (Collins). **Massachusetts.** (Collins). **Connecticut.** Forming a crust on stones between tide marks. Fresh Pond, Stratford. August 1895. (Holden). **New Jersey.** On old shells. Atlantic City. (Morse, Collins). "Forming a crumbly incrustation at high-water mark, and seeming to prefer lagoons or high tide-pools, where the water is quite salt and where the level does not vary much."—Collins.

55. *Entophysalis magnoliae* Farlow. Marine Algae of New England. 29. 1881. De Toni. Syll. Algar. 5: 58. 1907.

Collins. Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 41. 1900.

Plant mass mucous; families densely branched; cells 4-6 mic. in diameter, dark purple, united in twos and fours, embedded in jelly.

Maine. (Collins). **Massachusetts.** Forming a thin slime on exposed rocks. Rare. Autumn. Magnolia Cove, Gloucester. (Farlow).

Genus **CHONDROCYSTIS** Lemmerm.

Abh. Nat. Ver. Bremen. 353. 1899.

Plant mass cushion-shaped, widely expanded, up to 35 cm. high, cartilaginous, soft, fragile, encrusted with lime at the base, curled up at periphery; families consisting of spherical masses of cells lying free, the membranes of which seem to be thickened into one layer.

56. *Chondrocystis schauinslandii* Lemmermann. Ergebn. einer Reise n. d. Pacific. Abh. Nat. Ver. Brem. 16: 353. 1899; Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 615. pl. 7. f. 22-29. 1905. De Toni. Syll. Algar. 5: 59. 1907.

Plate I. fig. 34-36.

Plant mass rose-colored to red, thick, cushion-like, widely expanded, encrusted with lime on the under side; cells somewhat spherical or elongate, 2 mic. in diameter, 3-5 mic. in length; sheath thick.

Hawaii. On sides of lagoon. Island of Laysan. (Schauinsland).

Genus **GLOEOTHECE** Naegeli. Gatt. Einz. Alg. 57. 1849.

Colonies embedded in a common gelatinous tegument; cells cylindrical-oblong, rounded at the ends, each surrounded by a wide mucous homogeneous or lamellose sheath; reproduction by transverse division of the cells in one direction only.

I Individual sheaths colorless

- 1 Cells .8-2.5 mic. in diameter, 10.5-18 mic. in length **G. linearis**
- 2 Cells 1.6-3 mic. in diameter, 2.2-7.5 mic. in length **G. confluens**
- 3 Cells 4-5.5 mic. in diameter, 6-15 mic. in length **G. rupestris**
- 4 Cells 4-5 mic. in diameter, 6-10 mic. in length **G. membranacea**
- 5 Cells 2.5-2.7 mic. in diameter, 4.8-5.7 mic. in length, somewhat crescent-shaped with acute apices **G. lunata**

II Individual sheaths partly or entirely colored

- 1 Plant mass usually free-floating
 - (1) Sheaths colorless at margins; cells 3-4 mic. in diameter **G. magna**
 - (2) Sheaths usually brownish or yellowish; cells 4-5.5 mic. in diameter, 6-11 mic. in length **G. fuscolutea**

57. **Gloeotheca linearis** Naegeli. Gatt. Einz. Alg. 58. 1849. De Toni. Syll. Algar. 5: 62. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 276. 1895.

Plate II. fig. 1, 2.

Plant mass gelatinous, dull yellow becoming reddish; plants 9.5-10.5 mic. in diameter, 10.5-18 mic. in length; sheaths very wide, colorless, hyaline, oblong or somewhat reniform; cells .8-2.5 mic. in diameter, 10.5-18 mic. in length, linear-cylindrical, straight or curved, usually single; cell contents pale blue-green or green.

West Indies. On damp wall of dam, Sharp's River, St. Vincent. (Elliott).

58. **Gloeotheca confluens** Naegeli. Gatt. Einz. Alg. 58. pl. 1 G. f. 1. 1849. De Toni. Syll. Algar. 5: 60. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877; Fresh-Water Algae U. S. 325. pl. 210. f. 6. 1887. **Collins.** Algae of Middlesex County. 16. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 610. 1889.

Plate II. fig. 3.

Plant mass gelatinous, amorphous, pale reddish-yellow or greenish; plants 9-10 mic. in diameter, 12-16 mic. in length; sheaths wide, hyaline, colorless; cells 1.6-3. mic. in diameter, 2.2-7.5 mic. in length, oblong-cylindrical, single or in pairs; cell contents homogeneous, greenish or becoming paler.

Massachusetts. Calcareous springs. Newton. (Farlow). **New Jersey.** On wet rocks. (Wolle). **Pennsylvania.** On wet rocks. Bethlehem. (Wolle).

59. *Gloeotheca rupestris* (Lyngbye) Bornet. Les Algues de P. K. A. Schousboe. 177. 1892. Wittrock and Nordstedt. Alg. Aq. Dulc. Exsicc. no. 399. 1880. De Toni. Syll. Algar. 5: 63. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 703. 1900; Phyc. Bor.-Am. Fasc. 25. no. 1204. 1905., (G. cystifera (Hass.) Rab.)

Plate II. fig. 4.

Families 25-45 mic. in diameter, spherical or oval, containing two, four or eight plants; plants 8-12 mic. in diameter, 12-36 mic. in length; sheaths colorless or brownish-yellow; cells 4-5.5 mic. in diameter, 6-15 mic. in length; cell contents blue-green.

California. On dripping boards. Lake Chabot. San Leandro, Alameda County. June 1902. (Osterhout and Gardner). **Bermudas.** On ground. Spanish Point. Bermuda. January 1900. (Farlow).

Var. *tepidarium* (A. Br.) Hansirg. Prodromus. 2: 136. f. 46. 1892. De Toni. Syll. Algar. 5: 64. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 13. no. 601. 1899. (G. cystifera (Hass.) Rab.).

Plant mass dusky olive or brownish blue-green, often widely expanded; families 21-40 mic. in diameter, 30-50 mic. in length, containing usually two or four plants; cells 5-6 mic. in diameter, 5-15 mic. in length, elliptical or long-cylindrical, after division almost spherical; cell contents finely granular, blue-green.

Rhode Island. On wood work of a dam. Centredale. April 1894. (Osterhout).

60. *Gloeotheca membranacea* (Rabenhorst) Bornet. Les Algues de P. K. A. Schousboe. 175. 1892. De Toni. Syll. Algar. 5: 61. 1907.

Plant mass membranaceous (resembling a *Nostoc*), dark olive green; cells 4-5 mic. in diameter, 6-10 mic. in length, always oblong before division; sheaths disappearing after third or fourth division.

North America. (Collins).

61. *Gloeotheca lunata* W. and G. S. West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 277. pl. 16. f. 9. 1895. De Toni. Syll. Algar. 5: 65. 1907.

Plate II. fig. 5.

Colonies 19 mic. in diameter, 32.5 mic. in length, oval or elliptical; cells 2.5-2.7 mic. in diameter, 4.8-5.7 mic. in length, somewhat crescent shaped, with acute apices, associated in families of two or four; cell contents homogeneous, blue-green.

West Indies. On damp wall of dam. Sharp's River. St. Vincent. May 1892. (Elliott).

62. *Gloeotheca magna* Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. De Toni, Syll. Algar. 5: 62. 1907.

Plant mass large, thin, irregularly oblong, pale yellowish green; colony containing many plants; sheaths usually colorless at the margins; cells 3-4 mic. in diameter, nearly twice as long as wide.

Pennsylvania. Forming a coating on small water plants, or floating in ponds, many families joined together. Near Bethlehem. (Wolle).

63. *Gloeotheca fuscolutea* Naegeli. Gatt. Einz. Alg. 58. 1849. De Toni. Syll. Algar. 5: 66. 1907.

Tilden. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 113. 1901. American Algae. Cent. V. no. 500. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 147. 1902.

Plant mass soft, gelatinous, blue-green; sheaths thick, lamellose, colorless, brownish or yellowish; cells 4-5.5 mic. wide, 6-11 mic. long, oblong-cylindrical, single or associated in families of four or eight; cell contents blue-green.

Hawaii. Covering surface of water in plat in rice field. Aiea. Oahu. June 1900. (Tilden).

Genus **APHANACAPSA** Naeg. Gatt. Einz. Alg. 52. 1849.

Plant mass more or less expanded, colorless or blue-green, yellow or brown; plants spherical or angular from mutual pressure, single or in pairs; individual sheaths thick, very soft, colorless, not distinct, confluent into a mucous, amorphous, homogeneous colonial tegument; tegument colorless or tinted brown or blue-green; reproduction by successive division of the cells alternately in three directions.

I Plant mass colorless.

- | | |
|--------------------------------|----------------------|
| 1 Cells 1.5-2 mic. in diameter | <i>A. elachista</i> |
| 2 Cells 10-16 mic. in diameter | <i>A. zanardinii</i> |

II Plant mass green or blue-green.

- | | |
|--|---------------------|
| 1 Plant mass globose, gelatinous, dirty green; cells 3.2-5.6 mic. in diameter | <i>A. grevillei</i> |
| 2 Plant mass hemispherical, gelatinous, blue-green; cells 5-6 mic. in diameter | <i>A. rivularis</i> |

- 3 Plant mass amorphous, gelatinous, dirty green or olive

A. virescens

- III Plant mass brown.

Cells 4.5-5.5 mic. in diameter

A. brunnea

64. *Aphanocapsa elachista* W. and G. S. West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 276. pl. 15. f. 9, 10. 1895. De Toni. Syll. Algar. 5: 73. 1907.

Plate II. fig. 6.

Colonies 26-38 mic. in diameter, not forming a distinct plant mass, very small, somewhat globose; sheaths firm, gelatinous, colorless, not lamellose, soon diffuent; cells 1.5-2 mic. in diameter, spherical, single or in pairs, loosely arranged; cell contents homogeneous, blue-green.

West Indies. On trees. Summit of Trois Pitons (4500 feet elevation). November and December 1892; in stream, Grande Soufrière, Dominica. (Elliott).

"This species seems characteristically distinct by reason of its minute cells in the very small, globose colonies, which were scattered amongst other algae."—West.

65. *Aphanocapsa zanardinii* (Hauck) Hansgirg. De Toni. Syll. Algar. 5: 67. 1907.

Plant mass colorless; cells 10-16 mic. in diameter, globose, single or in families of two or four; individual sheaths very thin, hyaline, scarcely visible; cell contents homogeneous, sometimes granular, emerald green.

Massachusetts. (Collins).

66. *Aphanocapsa grevillei* (Hassall) Rabenhorst. Fl. Eur. Algar. 2: 50. 1865. De Toni. Syll. Algar. 5: 73. 1907.

Wolle. Fresh-Water Algae. U. S. 333. pl. 210. f. 38, 39. 1887. **Bennett.** Plants of Rhode Island. 115. 1888. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate II. fig. 7.

Plant mass gelatinous, globose, densely aggregated, more or less confluent, dirty green, when dry becoming olive or brownish; sheaths soon diffuent; cells 3.2-5.6 mic. in diameter, spherical or elliptical, rather crowded, single or in pairs; cell contents finely granular, blue-green.

Greenland. (Boergesen). **Pennsylvania.** Submerged stones in shallow pond water. (Wolle). **Rhode Island.** Benedict and other ponds. (Bennett). **Iowa.** Pond near R. R. Ames. 1905. (Buchanan).

67. *Aphanocapsa rivularis* (Carmichael) Rabenhorst. Fl. Eur. Algar. 2: 49. 1865. De Toni. Syll. Algar. 5: 69. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877.

Plate II. fig. 8, 9.

Plant mass hemispherical, gelatinous, tuberculose, often confluent, blue-

ish-green becoming brownish when dry; sheaths very thick, not lamellose, colorless, soon diffuent; cells 5-6 mic. in diameter, spherical, scattered, single or in pairs; cell contents finely granular, blue-green.

Pennsylvania. In ponds attached to wood or stone. (Wolle).

68. *Aphanocapsa virescens* (Hassall) Rabenhorst. Fl. Eur. Algar. 2: 48. 1865. De Toni. Syll. Algar. 5: 68. 1907.

Wolle. Fresh-Water Algae U. S. 333. pl. 210. f. 33. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 612. 1889. **West.** The Freshwater Algae of Maine. Journ. of Bot. 27: 207. 1889.

Plate II. fig. 10, 11.

Plant mass amorphous, gelatinous, more or less expanded, dirty green or olive, becoming brownish; sheaths scarcely visible, diffuent; cells about 6 mic. in diameter, globose, single or in pairs; cell contents homogeneous, often showing a central granule, pale blue-green.

Maine. (West). **New Jersey.** On wet stones and rocks. (Wolle).

69. *Aphanocapsa brunnea* Naegeli. Gatt. Einz. Alg. 52. 1849. De Toni. Syll. Algar.*5: 71. 1907.

Wolle. Fresh-Water Algae U. S. 329. 1887.

Plant mass gelatinous, membranaceous, expanded, brownish; sheaths not visible; cells 4.5-5.5 mic. in diameter, spherical, in division oblong, single or in pairs, crowded; cell contents finely granular, pale yellowish brown or greenish brown.

North America. Forming brownish-olive, floating masses in stagnant waters. (Wolle). **Canada.** Minnesota Seaside Station, Vancouver Island. British Columbia. July 1901. (Crosby and Leavitt).

Genus **APHANOTHECE** Naeg. Gatt. Einz. Algar. 59. 1849.

Plant mass more or less expanded, somewhat spherical or without definite shape; individual sheaths thick, not distinct, confluent into a mucous, amorphous, homogeneous colonial tegument; cells oblong; reproduction by division of the cells in one direction only.

I Plant mass without definite shape.

1 Cells 1-2 mic. in diameter

A. saxicola

2 Cells more than 2 mic. in diameter

(1) Plant mass dirty green or olive brown; cells 2.5-3 mic. in diameter

A. conferta

(2) Growing in very salt water; cells 5 mic. in diameter, hardly longer than broad

A. utahensis

(3) Cells one to three times as long as broad

A Plant mass colorless; cells 4-4.5 mic. in diameter

A. microscopica

- B Plant mass colored
 - a Plant mass blue-green, olive or yellowish-brown; cells 2-3.5 mic. in diameter *A. castagnei*
 - b Plant mass pale blue-green; cells 3-8 mic. in diameter *A. pallida*
 - c Plant mass pale yellowish-green or olive; cells 2-3 mic. in diameter *A. microspora*
 - d Plant mass yellowish-brown or olive; cells 4-4.5 mic. in diameter, irregularly scattered *A. naegelii*
- II Plant mass more or less spherical
 - 1 Plant mass pale blue-green; cells 3-5 mic. in diameter *A. stagnina*
 - 2 Plant mass bright or dark emerald green; cells 5-6.5 mic. in diameter *A. prasina*

70. *Aphanothece saxicola* Naegeli. Gatt. Einz. Alg. 60. pl. 1 H. f. 2. 1849. De Toni. Syll. Algar. 5: 81. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 25. no. 1203. 1905; Phyc. Bor.-Am. Fasc. 27. no 1301. 1906. West and West. On some Fresh-water Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 277. 1895.

Plant mass mucous-gelatinous, colorless or yellowish, without definite shape; cells 1-2 mic. in diameter, 2-6 mic. in length, somewhat cylindrical, with rounded ends, single or in pairs, sometimes surrounded by many partially dissolved sheaths; cell contents pale blue-green.

Massachusetts. Forming soft masses of irregular form, floating among other algae. Horn Pond. Woburn. September 1905. (Collins). **California.** Walls of reservoir. Del Monte, Monterey County. September 1902. (Osterhout). **West Indies.** "In small masses of 70-120 mic. in diameter, amongst mosses on trees. Rather scarce." Summit of Trois Pitons (4500 feet), Dominica. November and December 1892. (Elliott).

71. *Aphanothece conferta* Richter in Hauck and Richter. Phykotheke Universalis. no. 487. 1892. De Toni. Syll. Algar. 5: 84. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1152. 1904.

Plant mass gelatinous-mucous, membranaceous, expanded, dirty green or olive brown; individual sheaths colorless, diffuent; cells 2.5-3 mic. in diameter, 4.5-5.5 mic. in length, spherical or oblong, single or in pairs, crowded in families; cell contents finely granular, pale blue-green or olive.

California. On trunk of Bay tree. Strawberry Creek, Berkeley. March 1903. (Gardner).

72. *Aphanothece utahensis* Tilden. American Algae. Cent. III. no. 297. 1898.

Plant mass 1-6 cm. in diameter, forming thin, gelatinous, brown and blue-green membranes; cells 5 mic. in diameter, oval or nearly spherical, single or in twos.

Utah. Floating near shore of lake and washed up on beach. Garfield Beach, Great Salt Lake. July 1897. (Tilden).

73. *Aphanotheca microscopica* Naegeli. Gatt. Einz. Alg. 59. pl. 1 H. f. 1. 1849. De Toni. Syll. Algar. 5: 83. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 277. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 12. no. 552. 1899. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. 1901. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904.

Plate II. fig. 12.

Plant mass .25-2 mm. in diameter, gelatinous, colorless, globose or oblong, later irregular in shape, floating; cells 4-4.5 mic. in diameter, 6-9 mic. long, oblong-cylindrical, single or in twos; cell contents blue-green.

Greenland. (Richter, Boergesen). **Alaska.** Forming a slimy coating, with *Chroococcus*, on a perpendicular cliff over which water was trickling. Juneau. (Saunders). **New Hampshire.** On wall of the "Flume." (Collins). **Massachusetts.** On flower pots. Botanic Garden. Cambridge. February 1895. (Richards). **West Indies.** On damp wall of dam. Sharp's River, St. Vincent; on trees, summit of Trois Pitons (4500 feet), Dominica. (Elliott).

74. *Aphanotheca castagnei* (Brébisson) Rabenhorst. Fl. Eur. Algar. 2: 64. 1865. De Toni. Syll. Algar. 5: 81. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 180. 1903.

Plate II. fig. 13.

Plant mass gelatinous, amorphous, expanded, bluish-green, olive or yellowish-brown; sheaths not usually visible; cells 2-3.5 mic. in diameter, 3-8 mic. in length, globose, oblong or polygonal, of various sizes, somewhat crowded; cell contents pale blue.

Alaska. In sulphur waters. (Farlow, Setchell). **Washington, D. C.** (Farlow). **Washington.** In a jar of water in the laboratory. University of Washington, Seattle. (Gardner).

75. *Aphanotheca pallida* (Kuetzing) Rabenhorst. Fl. Eur. Algar. 2: 64. 1865. De Toni. Syll. Algar. 5: 83. 1907.

Wolle. Fresh-Water Algae U. S. 325. pl. 210. f. 7, 8. 1887.

Plant mass 4-6 mm. in diameter, gelatinous, soft, somewhat transparent, pale blue-green; cells 3-8 mic. in diameter, 5-24 mic. in length, oblong-elliptical or cylindrical, usually scattered; cell contents pale blue-green.

Pennsylvania. On wet or marshy ground. (Wolle). **Minnesota.** Keegan's Lake, Minneapolis. October 1907. (Hone).

76. *Aphanotheca microspora* (Meneghini) Rabenhorst. Fl. Eur. Algar. 2: 64. 1865. De Toni. Syll. Algar. 5: 84. 1907.

Richter. Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. Heft. 42.

3. 1897. **Saunders**. The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. 1901. **Setchell and Gardner**. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 180. 1903. **Collins**. Algae of the Flume. Rhodora. 6: 230. 1904.

Plant mass amorphous, irregularly lobed, gelatinous-mucous, soft, hyaline, pale yellowish-green or olive; sheaths colorless, usually entirely dissolved; cells 2-3 mic. in diameter, 4-9 mic. in length, oblong, single or in pairs; cell contents pale blue.

Greenland. Umanak. (Vanhöffen.). **Alaska**. Forming with *Chroococcus turgidus*, a slimy coating on a perpendicular cliff, over which water was trickling. Juneau. (Saunders). **New Hampshire**. (Collins).

77. **Aphanothece naegelii** Wartmann in Rabenhorst. Fl. Eur. Algar. 2: 65. 1865. De Toni. Syll. Algar. 5: 77. 1907.

Tilden. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 113. 1901; American Algae. Cent. V. no. 497. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 153. 1902.

Plate II. fig. 14.

Plant mass gelatinous, yellowish-brown or olive, adhering to paper when dried; sheaths diffuent; cells 4-4.5 mic. in diameter, 6.5-8 mic. in length, oblong or oval, almost spherical after division, irregularly scattered, rather densely crowded; cell contents pale blue-green.

Hawaii. Forming soft, olive-brown lumps on sides of damp cliff among mosses and liverworts. Elevation 350 feet. Kaliawaa Falls. Makao, Koolauloa, Oahu. June 1900. (Tilden).

78. **Aphanothece stagnina** (Sprengel) A. Braun in Rabenhorst. Fl. Eur. Algar. 2: 66. 1865. De Toni. Syll. Algar. 5: 76. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 180. 1903. **Collins, Holden and Setchell**. Phyc. Bor.-Am. Fasc. 27. no. 1302. 1906.

Plate II. fig. 15.

Plant mass .5-2 cm. in diameter, gelatinous, oblong, elliptical or nearly globose, hyaline, pale blue-green; cells 3-5 mic. in diameter, 5-8 mic. in length, oblong-oval; cell contents pale blue-green.

Alaska. (Farlow). **Michigan**. Forming firm, light green, spherical or tuberculate floating masses. Walnut Lake, Oakland County. May 1906. (Hankinson).

79. **Aphanothece prasina** A. Braun in Rabenhorst. Fl. Eur. Algar. 2: 65. 1865. De Toni. Syll. Algar. 5: 78. 1907.

Wolle. Fresh-Water Algae U. S. 325. pl. 210. f. 9, 10. 1887. **Collins**. Algae of Middlesex County. 16. 1888. **Wolle and Martindale**. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 610. 1889. **Collins, Holden and Setchell**. Phyc. Bor.-Am. Fasc. 6. no. 251. 1897. **Tilden**. Collection of Algae from the Hawaiian Islands. Haw.

Almanac and Annual for 1902. 113. 1901; American Algae. Cent. V. no. 498. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 146. 1902.

Plate II. fig. 16.

Plant mass gelatinous, more or less globose, tuberculose or angular, bright emerald green, sometimes confluent and then lobed; sheaths diffuent; cells 5-6.5 mic. in diameter, 7.7-11 mic. long, oblong or ovoid, often spherical after division; cell contents blue-green.

Massachusetts. Cambridge. (Farlow). **Connecticut.** In free swimming gelatinous masses of a yellowish or bluish green color, globular when young, later becoming irregular in shape. Norwich. September 1892. (Setchell). **New Jersey.** Floating on ponds. (Wolle). **Hawaii.** Forming free-swimming, blue-green tuberculose, globose or flattened soft masses, floating in ditch in rice field near beach. Aiea, Oahu. June 1900; in brackish, stagnant water. Meheiw, Makao, Koolauloa, Oahu. June 1900. (Tilden).

Genus **MICROCYSTIS** Kuetz. Linnaea 8: 372. 1833.

Colonies spherical or somewhat spherical, solid, finally becoming hollow and lobed, single or associated in clusters, containing large numbers of cells, surrounded by a colorless, gelatinous tegument; cells spherical, oval or elliptical; cell contents green or blue-green, often showing vacuoles; reproduction by cell division in three directions.

I Cells spherical.

- 1 Colonies more or less spherical, usually containing several daughter colonies each surrounded by its own tegument; cells 2-4 mic. in diameter *M. ichthyoblabe*
- 2 Plant mass dull yellowish becoming olive; colonies 30-70 mic. in diameter; cells 2.2-4 mic. in diameter *M. donnellii*
- 3 Colonies spherical, flattened, orbicular, lens-shaped, sometimes confluent, surrounded by a thick, lamellose common tegument; cells 3-4 mic. in diameter *M. marginata*
- 4 Colonies more or less spherical or oblong, with an indistinctly limited tegument, pale or yellowish-green; cells 4-6.5 mic. in diameter. *M. flos-aquae*

II Cells oval or oblong, sometimes almost spherical.

- 1 Colonies spherical, oblong or flattened, sometimes containing several daughter colonies each surrounded by its own tegument; cells 1-1.5 mic. in diameter, 3-5 mic. in length, oblong *M. elabens*
- 2 Plant mass pulverulent, bright glaucous or whitish blue-green; colonies spherical or oblong; cells 2-3 mic. in diameter, somewhat spherical or oval *M. pulverea*
- 3 Plant mass irregular, firm, gelatinous, pink, brown or green, growing in very salt water; cells 2.5-4 mic. in diameter, 6-7 mic. in length, oblong or elliptical *M. packardii*
- 4 Plant mass mucous, floccose, amorphous, sky-blue; colonies somewhat

spherical, distinctly limited; cells somewhat spherical or ellipsoid
(size unknown) *M. piscinalis*

- 5 Colonies irregular in shape, with an indistinctly limited tegument;
cells 5-5.5 mic. in diameter, spherical or oval

M. pallida

80. *Microcystis ichthyoblabe* Kuetzing. Tab. Phyc. 1: 7. pl. 8. 1845-1849.
De Toni. Syll. Algar. 5: 88. 1907.

Wolle. Fresh-Water Algae U. S. 330. 1887. Wolle and Martindale.
Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J.
2: 611. 1889. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm.
Bull. for 1902. 22: 392. 1903. (*Polycystis icthioblabe* Kg.)

Colonies membranaceous, thin, more or less spherical, surrounded by a
common gelatinous tegument, usually containing several daughter colonies
each surrounded by its own tegument, blue-green; cells 2-4 mic. in diameter,
spherical; cell contents showing vacuoles, pale blue-green.

United States. (Pike, Farlow, Collins). New Jersey. Occasional
in small pools. (Wolle). Ohio. Put-in-Bay. Lake Erie. (Snow).

81. *Microcystis donnellii* Wolle. Fresh Water Algae. Bull. Torr. Bot. Club.
6: 282. 1879.

Plant mass dull yellowish becoming olive; colonies 30-70 mic. in diam-
eter, spherical or oval, often more or less angular, green; cells 2.2-4 mic.
in diameter; cell contents granular, green.

Maryland. In soft gelatinous masses, often nine and ten inches in
diameter, floating in ponds, Garrett County. July 1878. (Smith).

82. *Microcystis marginata* (Meneghini) Kuetzing. Tab. Phyc. 1: 6. pl. 8.
1845-1849. De Toni. Syll. Algar. 5: 91. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877.
(*Anacystis marginata* Menegh.); Fresh-Water Algae U. S. 329.
1887. (*A. marginata* Kg.) Fanning. Observations on the Algae
of the St. Paul city water. Minn. Bot. Studies. 2: 613. pl. 45. 1901. Saun-
ders. The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci.
3: 397. 1901. (*M. marginata* Naeg.) Setchell and Gardner. Algae
of Northwestern America. Univ. Calif. Pub. Bot. 1: 180. 1903. Clark.
The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala.
Proc. Biol. Soc. Wash. 21: 94. 1908.

Plate II. fig. 17.

Colonies spherical, flattened or orbicular and lens-shaped, sometimes
confluent, surrounded by a thick, lamellose common tegument, pale green,
colorless at the margin; cells 3-4 mic. in diameter, densely crowded, spher-
ical or sometimes angular; cell contents blue-green, becoming granular.

United States. In ponds of stagnant water. (Wolle). Alaska. Form-
ing a slimy coating on a perpendicular cliff. Near Juneau. (Saunders); form-
ing slimy coatings on dripping rocks. Glacier Valley, Unalaska. (Setchell
and Lawson). Minnesota. St. Paul city water. (Fanning). Central
America. Lake Amatitlan, Guatemala. (Meek).

83. *Microcystis flos-aquae* (Wittrock) Kirchner in Engler and Prantl. Nat. Pflanz. I 1 a. 56. f. 49 N. 1900. De Toni. Syll. Algar. 5: 86. 1907.
Tilden. Notes on a Collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 153. 1908.

Plate II. fig. 18.

Colonies more or less spherical or oblong, with an indistinctly limited tegument, often several lying close together, pale or yellowish blue-green; cells 4-6.5 mic. in diameter, spherical, often densely crowded; cell contents showing vacuoles, pale bluish-green.

Central America. Lake Amatitlan, Guatemala. Temperature of water 73°. January 1906. (Kellerman, Meek and Smith).

84. *Microcystis elabens* (Meneghini) Kuetzing. Tab. Phyc. 1: 6. pl. 8. 1845-1849. De Toni. Syll. Algar. 5: 88. 1907.

Farlow. Marine Algae of New England. 28. 1881. (*Polycystis elabens* Kuetz.). Martindale. Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. Collins. Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 249. 1894. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1101. 1903. Collins. Phycological Notes of the late Isaac Holden,—I. Rhodora. 7: 172. 1905.

Plate II. fig. 19.

Colonies spherical, oblong, or flattened, membranaceous, surrounded by a common gelatinous tegument, sometimes containing several daughter colonies each surrounded by its own tegument, bluish or olive-green; cells 1-1.5 mic. in diameter, 3-5 mic. in length, oblong; cell contents showing vacuoles.

Maine. On rocky sides of a tide pool at high water mark. Cape Rosier. July 1896; among small algae. Seal Harbor. (Collins). **New Hampshire.** (Collins). **Massachusetts.** "Common in summer on decaying algae, over which it forms slimy masses." Wood's Holl. (Farlow). **Rhode Island.** (Collins). **Connecticut.** On decaying algae. Fresh Pond. August. (Holden). **New York.** Prince's Bay, Staten Island. (Pike).

85. *Microcystis pulverea* (Wood) De Toni. Syll. Algar. 5: 92. 1907.

Wood. Contr. Hist. Freshwater Algae North America. 79. 1872. (*Pleurococcus pulvereus* Wood). Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877. (*Anacystis glauca* Wolle); Fresh-Water Algae U. S. 329. pl. 210. f. 25. 1887. (*A. pulvereus* (Wood) Wolle).

Plant mass pulverulent, bright glaucous or whitish blue-green, composed of very numerous and densely crowded colonies; colonies spherical or oblong, usually surrounded by a diffuent, hyaline tegument; cells 2-3 mic. in diameter, somewhat spherical, oval or angular, very much crowded; cell contents pale blue or olive green.

Pennsylvania. Forming an extended stratum over the bottom of limestone spring. The stratum is in places nearly an inch in thickness and when lifted by the hand is found to be loose and crumbly. "Boiling Springs", two miles from Bellefonte, Centre County. (Wood). On bottom of limestone springs. Northampton and Lehigh Counties. (Wolle).

86. *Microcystis packardii* (Farlow) nob. De Toni. Syll. Algar. 5: 93. 1907.

Packard. The Sea-weeds of Salt Lake. Am. Nat. 13: 701. 1879. (*Polycystis packardii* Farlow). **Tilden.** American Algae. Cent. III. no. 298. 1898.

Plate II. fig. 20.

Plant mass irregular in shape, firm, gelatinous, displaying various tints of pink, brown or green; cells 2.5-4 mic. in diameter, 6-7 mic. in length, oblong or elliptical.

Utah. Forming irregularly-shaped balls or masses of a firm gelatinous structure, showing various tints of pink, brown and green. In thick masses around edge of lake for a distance of forty feet out from shore and one to two feet in depth. Often washed ashore and left in beds on sand. Garfield Beach, Great Salt Lake. July 1897. (Tilden).

87. *Microcystis piscinalis* (Brügg.) De Toni. Syll. Algar. 5: 90. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 137. 1877. (*Polycystis piscinalis* Brügg.)

Plant mass mucous, floccose, amorphous, sky-blue, becoming gray-green when dried; colonies somewhat spherical, distinctly limited, many sometimes surrounded by a more or less dissolved common tegument; cells somewhat spherical or ellipsoid; cell contents homogeneous, blue-green.

Pennsylvania. In pools. Near Bethlehem. (Wolle).

88. *Microcystis pallida* (Farlow) Lemmermann. Algen. Kryptogamenflora der Mark Brandenburg. 3: 77. 1907. De Toni. Syll. Algar. 5: 93. 1907.

Collins. Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. (*Polycystis pallida* (Kuetz.) Farlow). **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 611. 1889. **Collins.** Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 249. 1894. Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 43. 1900.

Colonies irregular in shape, with an indistinctly limited tegument; cells 5-5.5 mic. in diameter, spherical or oval; cell contents bluish green.

Maine. Among small algae. Seal Harbor. (Collins). **Massachusetts.** Gloucester (Farlow). **Rhode Island.** Newport. (Farlow). **New Jersey.** On decaying algae. Atlantic City. (Morse).

Genus **CLATHROCYSTIS** Henfrey
Mic. Journ. 53. pl. 4. f. 28-36. 1856.

Colonies of variable shape, at first solid soon becoming saccate and clathrate, ("fragments of the broken fronds occurring in irregularly lobed forms"), surrounded by a colorless, gelatinous, indistinctly limited integument; cells spherical, numerous.

I Cells 3-4 mic. in diameter, spherical.

C. aeruginosa

II Cells 6-9 mic. in diameter, spherical or oval

C. robusta

89. **Clathrocystis aeruginosa** (Kuetzing) Henfrey. Mic. Journ. 53. pl. 4. f. 28-36. 1856. De Toni. Syll. Algar. 5: 94. 1907.

Wolle. Fresh-Water Algae U. S. 327. pl. 210. f. 17, 18. 1887. **Collins.** Algae of Middlesex County. 16. 1888. **Bennett.** Plants of Rhode Island. 115. 1888. **Jelliffe.** A Further Contribution to the Microscopical Examination of the Brooklyn Water Supply. Brook. Med. Journ. 8: 592. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 2. no. 51. 1895. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 126. 1896. **Tilden.** List of Freshwater Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896; American Algae. Cent. II. no. 194. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 24. no. 1153. 1904. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate II. fig. 21, 22.

Plant mass a bright green scum, floating in vast strata on freshwater pools, presenting to the naked eye a finely granular appearance, when dried appearing like a crust of verdigris; colonies spherical or elongate, solid, soon becoming saccate and clathrate; cells 3-4 mic. in diameter, spherical, very numerous embedded in a colorless integument.

United States. Often floating in large strata as a glaucous green scum on fresh water pools. (Wolle). **Massachusetts.** Horn Pond, Woburn. (Farlow). Spot Pond, Stoneham; forming a floating scum on Middle Reservoir. Middlesex Fells. (Collins). **Rhode Island.** Common, at times abundant. (Bennett). Mashapaug Pond, Providence. October 1892. (Osterhout). **New York.** Brooklyn water supply. (Jelliffe). **Minnesota.** Covering surface of lake in sheltered bays and around edges, sometimes to a depth of three inches. In decaying forms a milky white, ill-smelling scum. Long Lake, Hennepin County. September 1895. (Shaver and Tilden). On bottom at edge of lake in very small round bunches or flat patches, fragile. Como Park, St. Paul. August 1895. (Tilden). Halsted's Bay, Lake Minnetonka. November 1906. (Hill). Minneapolis city water (Corbett). **Iowa.** Ames. 1884. (Bessey). East Okoboji Lake. October 1904. (Buchanan). **Washington.** Floating in Green Lake. Seattle. December 1903. (Gardner).

"The smallest fronds met with are usually roundish or ellipsoidal. When quite young they appear to be solid, but as they grow by the multiplication of the internal cells and the secretion of gelatinous matter, the

expansion takes place chiefly near the periphery, so that the frond becomes a hollow body. The walls of the sac then give way, and, as the expansion proceeds, orifices are formed in different parts, until the whole becomes a coarsely latticed sac or clumsy net of irregularly lobed form. Then this becomes broken up into irregular fragments of all shapes and sizes each of which recommences the expanding growth, and becomes a latticed frond."—Henfrey.

90. *Clathrocystis robusta* Clark. The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala. Proc. Biol. Wash. 21: 94. 1908.

Colony when young dense, spherical, surrounded by a gelatinous tegument, later perforate, clathrate or broken up into elongate rounded lobes; tegument tardily deliquescent, finally wholly dissolving, leaving a densely cohering mass of cells; cells 6-9 mic. in diameter, spherical or oval; cell contents (in formalin) bright blue-green.

Central America. Forming a flocculent bright blue-green scum on surface of water. Lake Amatitlan, Guatemala. February 1906. (Meek).

Genus **GOMPHOSPHERA** Kuetz.

Alg. Exsicc. Dec. 16. no. 151. 1836.

Colonies spherical or ellipsoid, mucous, solid, free-swimming; tegument colorless or yellowish, usually thick, soon diffuent; cells pear-shaped or heart-shaped, rarely somewhat spherical, grouped in pairs, few in numbers, disposed chiefly towards the periphery of the tegument; cell contents often granular, bluish or greenish; reproduction by cell division alternately in three directions.

- I Cells 4-5 mic. in diameter, 8-12 mic. in length *G. aponina*
 II Cells 3.2-4 mic. in diameter, spherical; cell contents pinkish or brownish *G. rosea*

91. *Gomphosphaeria aponina* Kuetzing. Alg. Exsicc. Dec. 16. no. 151. 1836. De Toni. Syll. Algar. 5: 97. 1907.

Wolle. Fresh-Water Algae United States. 328. pl. 210. f. 20-22. 1887. Bennett. Plants of Rhode Island. 115. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 611. 1889. Tilden. List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894; List of Fresh-Water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 600. 1896; American Algae Cent. III. no. 300. 1898. Lemmermann. Planktonalgen Ergebn. einer Reise. n. d. Pacific. Abh. Nat. Bremen. 16: 313. 1899. Setchell. Notes on Cyanophyceae.—III. Erythea. 7: 54. 1899. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. Snow. The Plankton Algae of Lake Erie. U. S. Fish Commission Bull. for 1902. 22: 392. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 180. 1903. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 616. 1905. Riddle. Brush Lake Algae. Ohio Nat. 5: 268. 1905. Clark. The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala.

Proc. Biol. Soc. Wash. 21: 96. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate II. fig. 23-28.

Colonies 50-90 mic. in diameter, spherical or nearly spherical, blue-green often becoming pale; tegument colorless, rather thick, lamellose; individual sheaths colorless; cells 4-5 mic. in diameter, 8-12 mic. in length, pear-shaped or club-shaped, stalked, surrounded by individual sheaths; stalks thick, broad, gelatinous; cell contents not showing vacuoles, blue-green, sometimes green or orange.

United States. Frequent in small pools. (Wolle). **Rhode Island.** Providence. (Bennett). **New Jersey.** In ponds and pools. (Wolle). **Ohio.** Plankton. Put-in-Bay, Lake Erie. (Snow). Brush Lake, Champaign County. (Riddle). **Minnesota.** Pool near Lake Kilpatrick. July 1893. (Baldard). In tank in Botanical laboratory. University of Minnesota, Minneapolis. October 1895; in covered tank. Zoological laboratory. University of Minnesota, Minneapolis. April 1898. (Tilden). **Iowa.** Found only once. Stagnant pool. Eagle Grove. 1904. (Buchanan). **Nebraska.** In aquaria. Lincoln. (Bessey). **Washington.** Floating intermingled with other algae in brackish waters. Whidbey Island. (Gardner). **California.** Near Los Angeles. (Monk). **Central America.** Lake Amatitlan, Guatemala. (Meek). **Hawaii.** Among marine algae. Island of Laysan. (Schauinsland).

Var. *cordiformis* Wolle. Fresh-Water Algae. VI. Bull. Torr. Bot. Club 9: 25. 1882. Bot. Notiser. 61. 1882. De Toni. Syll. Algar. 98. 1907.

Colonies 60 mic. in diameter; cells 6-13 mic. in diameter, 9-16 mic. in length, usually numerous.

Pennsylvania. Small ponds near Bethlehem. (Wolle).

92. *Gomphosphaeria rosea* (Snow) Lemmermann. Algae. Krypt. der Mark Brandenburg. 3: 80. 1907.

Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 387, 390, 392. pl. 4. f. 17. 1903. (*Coelosphaerium roseum*).

Colonies 35-52 mic. in diameter, spherical; tegument thin, gelatinous; cells 3.2-4 mic. in diameter, spherical, without individual sheaths, stalked; stalks, gelatinous, dichotomously branched; cell contents pinkish or brownish.

Ohio. Plankton. Put-in-Bay, Lake Erie. (Snow).

Genus *Coelosphaerium* Naeg. Gatt. Einz. Alg. 54. 1849.

Colonies spherical, mucous, hollow, free-swimming, containing many small cells; tegument mucous, soon confluent; cells globose, elliptical or ovoid, arranged just within the periphery of the tegument; cell contents granular, with gas vacuoles; reproduction by cell division, at first in one direction, afterwards alternately in three directions.

I Colonies 30-90 mic. in diameter; cells 2-5 mic. in diameter

C. kuetzingianum

II Colonies about 150 mic. in diameter; cells 5-7 mic. in diameter

C. dubium

93. *Coelosphaerium kuetzingianum* Naegeli. Gatt. Einz. Alg. 54. pl. I. C. 1849. De Toni. Syll. Algar. 5: 100. 1907.

Farlow. Notes on Fresh-Water Algae. Bot. Gaz. 8: 224. 1883. Campbell. Plants of the Detroit River. Bull. Torr. Bot. Club. 13: 93. 1886. Wolle. Fresh-Water Algae U. S. 327. pl. 210. f. 16. 1887. Arthur. Some Algae of Minnesota supposed to be Poisonous. Fourth Bien. Rep. Bd. Regents Univ. of Minn. Suppl. 1. Rep. Dept. Agric. Univ. of Minn. 103. 1887. Wittrock and Nordstedt. Algae Aq. Dulc. Exsicc. no. 692. 1884. Bennett. Plants of Rhode Island. 115. 1888. Collins. Algae of Middlesex County. 16. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Survey. N. J. 2: 611. 1889. Trelease. The "Working" of the Madison Lakes. Trans. Wis. Acad. Sci. Arts and Letters. 7: 122. 1889. Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 126. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 53. 1899. Fanning. Observations on the Algae of the St. Paul city water. Minn. Bot. Studies. 2: 612. pl. 45. fig. 24. 1901. Riddle. Algae from Sandusky Bay. Ohio Nat. 3: 317. 1902. Nelson. Observations upon some Algae which cause "Water Bloom." Minn. Bot. Studies. 3: 56. pl. 14. 1903. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. Collins. Phycological Notes of the late Isaac Holden,—II. Rhodora. 7: 235. 1905. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate II. fig. 29.

Colonies 30-90 mic. in diameter, spherical; tegument colorless, thin, gelatinous, soon diffuent; cells 2-5 mic. in diameter, subspherical, oval or elongated, in twos or fours or finally irregularly arranged; cell contents finely granular, blue-green.

United States. In ponds and pools; stagnant waters. (Wolle). Massachusetts. Framingham. 1883. (Farlow). Scattered or as a scum on Spot Pond, Middlesex Fells; forming a dense scum on Winchester Reservoir, Winchester. October 1898. (Collins). Connecticut. On moist rocks. Sage's Ravine, below first falls, Twin Lakes, Salisbury. October. (Holden). Rhode Island. Providence. (Lathrop). New Jersey. On stagnant pools. (Wolle). Ohio. Sandusky Bay. (Riddle). Michigan. Grosse Isle, near the mouth of the Detroit River. Summer of 1885. (Campbell). Minnesota. Lake Sakatah and Lake Tetonka, Waterville. (Porter). St. Paul city water. (Fanning). Iowa. "A frequent alga in many permanent ponds, often floating in considerable quantities in the lakes." South Gar Lake, Dickinson County; Hewitt's Pond, Eagle Grove; margin of slough. Eagle Grove. 1904. (Buchanan).

94. *Coelosphaerium dubium* Grunow in Rabenhorst. Fl. Eur. Algar. 2: 55. 1865. De Toni. Syll. Algar. 5: 102. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 13. 1872.

Colonies about 150 mic. in diameter, irregular or sometimes spherical, mucous, free-swimming; tegument colorless, thick; cells 5-7 mic. in diameter, spherical; cell contents with gas vacuoles, blue-green.

Pennsylvania. Forming a dense scum on a stagnant brick pond, near Philadelphia. July. "The scum was of the color of 'pea-soup' and so thick was it, that I think a quart of the plants might have been readily gathered." (Wood).

Genus **COELOSPHAERIOPSIS** Lemmermann.

Abh. Nat. Bremen. 16: 352. 1899.

Colonies spherical, gelatinous, hollow; families clustered; cells spherical or elongate, arranged in a single peripheral layer; reproduction by cell division.

95. **Coelosphaeriopsis halophila** Lemmermann. Planktonalgen. Ergeb. einer Reise n. d. Pacific. Abh. Nat. Bremen. 16: 353. pl. 2. f. 25, 26, 1899; Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 616. pl. 7. f. 19-21. 1905. De Toni. Syll. Algar. 5: 103. 1907.

Plate II. fig. 30.

Colonies 30-500 mic. in diameter, spherical, gelatinous; cells 6 mic. in diameter, 6-9 mic. in length, spherical or elongate.

Hawaii. In salt lagoon. Island of Laysan. (Schauinsland).

Genus **TETRAPEDIUM** Reinsch.

Algenfl. von Franken. 37. 1867.

Cells solitary or occurring in families of from 2-16 each, compressed, quadrangular or triangular, equilateral, becoming subdivided into quadrate or wedge-shaped segments or rounded lobes, either by deep vertical or oblique incisions or by wide angular or rounded sinuses; cell contents blue-green; reproduction by cell division. (Single cells break apart by the incisions into four daughter cells each, the daughter cells after division forming separate individuals. The direction of the incisions is either perpendicular to the lateral margin or bisects the angles.)

96. **Tetrapedium trigonum**. W. and G. S. West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 277. pl. 16. f. 8. 1895. De Toni. Syll. Algar. 5: 113. 1907.

Plate II. fig. 31.

Cells 3.6×7.2 mic., triangular, with concave sides and somewhat rotund angles, elliptical in side view; cell contents homogeneous, pale blue-green.

West Indies. On damp wall of dam. Sharp's River, St. Vincent. May 1892. (Elliott).

Genus **MERISMOPEDIUM** Meyen

in Wiegmann Archiv. 2: 67. 1839.

Colonies flat, rectangular, free-floating; tegument somewhat thick, confluent; cells spherical, before division oblong, arranged in a rectilinear series in a single layer; cell contents usually without gas vacuoles, blue-

green, rarely violet, rose-pink or red; reproduction by division of the cells in two directions.

I Cells 5-7 mic. in diameter, 6-9 mic. in length.

1 Colonies 30 mic. in diameter; cells 5 mic. in diameter, somewhat spherical; cell contents blue-green or violet. *M. aerugineum*

2 Cells spherical or oblong *M. elegans*

3 Cells oval *M. novum*

II Cells 3-6 mic. in diameter.

1 Colonies 45-150 mic. in diameter; cells spherical or oval *M. glaucum*

2 Colonies large, more or less convolute; cells spherical or oblong *M. convolutum*

III Cells 1.3-2 mic. in diameter, somewhat spherical *M. tenuissimum*

97. *Merismopedium aerugineum* Brébisson in Kuetzing. Spec. Algar. 472. 1849; Tab. Phyc. 5: 13. pl. 38. f. 8. 1855. De Toni. Syll. Algar. 5: 107. 1907.

Richter. Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. Heft. 42. 3. 1897.

Plate II. fig. 32.

Plant mass somewhat limited, nearly colorless; colonies 30 mic. in diameter, 35-68 mic. in length, composed of from 4 to 64 cells; cells 5 mic. in diameter, somewhat spherical, crowded; cell contents blue-green.

Greenland. Umanak. (Vanhöffen).

Var. *violaceum* Rabenhorst. Die Algen Sachsens. no. 857. 1859. De Toni. Syll. Algar. 5: 107. 1907.

Saunders. Protophyta-Phycophyta. Flora of Nebraska. 17. 1894. Tilden. List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894.

Cells very much crowded; cell contents violet.

Wisconsin. Trout-merc. Osceola. October 1893. (MacMillan.) Nebraska. Quite common in stagnant ponds about Thedford, forming violet or purplish slimy masses sometimes reaching the size of one's hand. (Saunders).

98. *Merismopedium elegans* A. Braun in Kuetzing. Spec. Algar. 472. 1849. De Toni. Syll. Algar. 5: 104. 1907.

Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate II. fig. 33.

Colonies at first mucous, more or less limited, colorless, later becoming membranaceous, expanded, containing from 64 to 1856 cells, greenish; families quadrate, finally not distinctly limited; cells 5-7 mic. in diameter, 6-9 mic. in length, spherical or oblong; cell contents pale blue-green.

Ohio. Plankton. Put-in-Bay, Lake Erie. (Snow). Iowa. Slough bottom. Eagle Grove. 1904. (Buchanan).

99. *Merismopedium novum* Wood. Contr. Hist. Fresh-Water Algae. N. A. 14. pl. 8. f. 8. 1872. De Toni. Syll. Algar. 5: 105. 1907.

Plate II. fig. 34.

Colonies membranaceous, distinctly limited, with straight and entire margin, composed of very numerous cells; families containing usually sixteen cells; cells up to 6 mic. in diameter, oval, sometimes constricted in the middle, closely approximated; cell contents light bluish green.

Pennsylvania. Growing adherent to or entangled in, a lot of filamentous algae. Schuylkill River, near Philadelphia. (Wood).

Without a doubt this species is identical with *M. elegans*.

100. *Merismopedium glaucum* (Ehrenberg) Naegeli. Gatt. Einz. Alg. 55. pl. 1 D. f. 1. 1849. De Toni. Syll. Algar. 5: 105. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 3. 1878. **Campbell.** Plants of the Detroit River. Bull. Torr. Bot. Club. 13: 93. 1886. **Wolle.** Fresh-Water Algae United States. 326. pl. 210. f. 12-15. 1887. **Bennett.** Plants of Rhode Island. 115. 1888. **Mackenzie.** A Preliminary List of Algae collected in the neighborhood of Toronto. Proc. Can. Inst. III. 7: 270. 1890. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 16. pl. 1. f. 5. 1894. **Jelliffe.** A Further Contribution to the Microscopical Examination of the Brooklyn Water Supply. Brook. Med. Journ. 8: 592. 1894. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894. **Fanning.** Observations on the Algae of the St. Paul city water. Minn. Bot. Studies. 2: 612. pl. 45. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 20. no. 953. 1902. **Riddle.** Algae from Sandusky Bay. Ohio Nat. 3: 317. 1902. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 617. 1905. **Riddle.** Brush Lake Algae. Ohio Nat. 5: 268. 1905. **Clark.** The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala. Proc. Biol. Soc. Wash. 21: 96. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate II. fig. 35.

Colonies 45-150 mic. in diameter, more or less limited, with slightly sinuate-crenate margin, light blue-green or glaucous green; cells 3-6 mic. in diameter, spherical or oval; cell contents pale blue-green or olive green.

Canada. High Park, Toronto, Ontario. (Mackenzie). **United States.** Not infrequent in ponds or sluggish waters. (Wolle). **Maine.** In a scum on a small artificial pond. Pogy Oil Factory. Round Pond. 16 July 1901. (Collins). **Rhode Island.** Providence. (Lathrop). **New York.** Brooklyn water supply. (Jelliffe). **Ohio.** Brush Lake, Champaign County; Sandusky Bay (Riddle). **Michigan.** Grosse Isle, near the mouth of the Detroit River. Summer of 1885. (Campbell). **Minnesota.** Peat-bog near Lake Kilpatrick, July 1893. (Ballard). St. Paul city water. (Fanning). **Iowa.** Floating in the quiet waters of ponds. Ames. 1884. (*M. nova*). (Bessey). Grinnell; Fayette. (Fink). Eagle Grove. Hewitt's Pond. 1904.

(Buchanan). **Nebraska.** Ponds and sluggish water. Not uncommon. (Saunders). **California.** In a small spring near San Pablo. September 1902. (Gardner). **Central America.** Only one specimen noted. "Amatitlan in 85 ft. water, towed in about 75 to 65, February 1, 1906, at middle of upper part of lake." (Meek). **Hawaii.** Island of Hawaii. (Berggren).

Var. *fontinale* Hansg. Phys. und. Algol. Mittheil IV. 98. 1890. De Toni. Syll. Algar. 5: 106. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1156. 1904.

Colonies 45 mic. in diameter, gelatinous, containing 8-64 cells; cells 2.5-3 mic. in diameter, approximate, densely aggregated; cell contents distinctly granular, pale blue-green.

California. On sandy ground. Lake Merced, San Francisco. (Gardner).

101. *Merismopedium convolutum* Brébisson in Kuetzing. Spec. Algar. 472. 1849. De Toni. Syll. Algar. 5: 108. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 15. 1872. **Wolle.** Fresh-Water Algae U. S. 326. pl. 210. f. 14. 1887. **Bennett.** Plants of Rhode Island. 115. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 611. 1889. **Harvey.** The Fresh-Water Algae of Maine.—III. Bull. Torr. Bot. Club. 19: 124. 1892. **Bessey.** Additions to the reported Flora of Nebraska made during 1893. Bot. Surv. Nebraska. 3: 5. 1894. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 17. 1894. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894. **Riddle.** Algae from Sandusky Bay. Ohio Nat. 3: 317. 1902. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 24. no. 1154. 1904. **Riddle.** Brush Lake Algae. Ohio Nat. 5: 268. 1905. **Brown.** Algal Periodicity in Certain Ponds and Streams. Bull. Torr. Bot. Club. 35: 248. 1908.

Plate II. fig. 36.

Colonies 1-4 mm. in diameter (visible to the naked eye), composed of very numerous cells, membranaceous, subfoliaceous, more or less convolute, greenish, bluish or yellowish; cells 4-5 mic. in diameter, 4-8 mic. in length, spherical or oblong; cell contents blue-green or yellowish.

United States. Shallow pools, forming a distinct layer upon the muddy bottom, or separating and then floating on the surface. (Wolle). **Maine.** Attached to spruce logs floating in the Penobscot River. Orono. October 1890. (Harvey). **Rhode Island.** Common. (Bennett). **New Jersey.** Frequent in ponds. (Wolle). **Pennsylvania.** "Making a distinct green layer upon the mud many feet in extent." In a very shallow, quiet, but fresh pool. Spring Mills, near Philadelphia. (Wood). **Ohio.** Brush Lake, Champaign County; Sandusky Bay (Riddle). **Indiana.** Faris Pond, Bloomington. February 1907 (Brown). **Minnesota.** Peat-bog near Lake Kilpatrick. July 1893. (Ballard). **Nebraska.** At the bottom of pools or floating upon the surface. (Saunders). **South Bend.** (Bessey). **California.** Floating all through the water in such abundance as to give it a bluish color. In Stone Lake. Golden Gate Park. San Francisco. August 1903. (Gardner.)

102. *Merismopedium tenuissimum* Lemmermann. Beitr. Kenntn. Planktonalgen. Bot. Centralb. 76: 154. 1898. De Toni. Syll. Algar. 5: 108. 1907.

Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903.

Plate II. fig. 37.

Colonies quadrangular, free-floating, containing sixteen cells; cells 1.3-2 mic. in diameter, somewhat spherical, crowded; cell contents pale bluish green.

Ohio. Plankton. Put-in-Bay, Lake Erie. (Snow).

Genus **EUCAPSIS** Clements and Shantz.

Minn. Bot. Studies. 4: 134. 1909.

Colonies cubical, usually consisting of 32-128 cells, but ranging from 8-512 cells, free-floating; tegument uniform, colorless, gelatinous; cells spherical, sometimes elliptical or flattened by mutual pressure, forming cubical families; cell contents finely granular, blue-green; reproduction by cell division in three planes.

103. *Eucapsis alpina* Clements and Shantz. Minn. Bot. Studies. 4: 134. 1909.

Plate II. fig. 38-40.

Colonies 30-80 mic. in diameter, usually containing 32-128 cells, cubical, free-floating; tegument colorless; cells 6-7 mic. in diameter, spherical, more rarely elliptic, in cubical families; cell contents blue-green.

Colorado. Alpine pond on Bald Mountain (12,000 feet). September 1904. (Shantz).

Genus **ONCOBYRSA** Agardh in Flora. 10: 629. 1827.

Colonies cushion-like, hard, leathery, adherent; sheaths thick, gelatinous, confluent; cells spherical or elongated, usually regularly arranged in radial rows; cell contents blue-green or violet.

I Cells pale blue-green, sometimes violet

O. rivularis

II Cells bright blue-green

O. cesatiana

104. *Oncobyrsa rivularis* (Kuetzing) Meneghini. Monogr. Nostoch. Ital. 96. 1846. De Toni. Syll. Algar. 5: 114. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 555. 1899.

Colony almost spherical, very smooth, opaque, dull brownish-green; tegument almost colorless, soon diffuent; cells 2-6 mic. in diameter, spherical or polygonal, arranged in regular radial rows; cell contents blue-green or violet.

United States. (Collins, Holden and Setchell).

105. *Oncobyrsa cesatiana* Rabenhorst. Fl. Eur. Algar. 2: 68. 1865. De Toni. Syll. Algar. 5: 116. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 180. 1903.

Plate II. fig. 41.

Colonies spherical, hard, solitary or in clusters, blue-green becoming dark-colored; tegument confluent, colorless; cells 1.2-2.5 mic. in diameter, 3 mic. in length, spherical or oblong, somewhat seriate, crowded at the periphery, few in the interior; cell contents homogeneous, light blue-green.

Alaska. Plentiful on water-moss in running fresh water. Near Iliuliuk, Unalaska. (Setchell and Lawson).

Genus **CHLOROGLOEA** Wille. *Algol. Notizen*. I-VI. 5. pl. 1. 1900.

Colonies irregularly lobed; tegument thin, not lamellose; cells spherical or oval, arranged in radiating series; reproduction by cell division in one direction.

106. **Chlorogloea tuberculosa** (Hansgirg) Wille. *Algol. Notizen*. I-VI. 5. pl. 1. 1900. De Toni. *Syll. Algar.* 5: 118. 1907.

Tilden. *American Algae*. Cent. IV. no. 382. 1900. (*Pringsheimia scutata cladophorae* Tilden).

Plate II. fig. 42.

Colonies disc-shaped, epiphytic, greenish; cells 1-1.5 mic. in diameter, 2 mic. in length; ellipsoid, after division somewhat spherical.

Canada. On *Cladophora* in tide pool. Minnesota Seaside Station. Vancouver Island, British Columbia. August 1898. (Tilden).

Family II. CHAMAESIPHONACEAE

Plants often showing a difference between basal and apical regions, solitary or associated in families or colonies, usually epiphytic or attached to shells; reproduction by cell division, by division of filaments into fragments, or by means of non-motile gonidia formed by the division of the contents of a mother cell or gonidangium.

I Reproduction by cell division and by gonidia; cells usually united in colonies

- 1 Colonies somewhat spherical or hemispherical, usually consisting of several layers of cells **Pleurocapsa**
- 2 Colonies disc-shaped, usually consisting of a single layer of cells **Xenococcus**
- 3 Colonies forming branched filaments **Hyella**

II Reproduction by gonidia only

- 1 Gonidia formed by simultaneous division of the entire contents of gonidangium **Dermocarpa**
- 2 Plants not usually united in colonies; gonidia formed by successive constrictions of apical portion of contents of gonidangium **Chamaesiphon**

Genus **PLEUROCAPSA** Thuret in Hauck.

Die Meeresalgen Deutschlands und Oesterreichs. 515. 1885.

Colonies usually crustaceous, made up of vegetative cells and gonidangia; plants united in short filaments, parallel or scarcely distinct, radiating, often dichotomously divided; cells spherical or angular, rarely oval or polyhedral; cell contents blue-green, olive, yellowish or violet; gonidangia furnished with thick sheaths, producing numerous, spherical gonidia; reproduction by cell division in three directions, by division of filaments into fragments, and by gonidia formed by division of the contents of a gonidium.

I Cells arranged in straight rows; growing in fresh water

Pl. concharum

II Cells not arranged in straight rows

1 Growing in hot water; cells 4-6 mic. in diameter

Pl. caldaria

2 Growing in salt water

(1) Cells 5-20 mic. in diameter; cell contents golden yellow, fawn-colored or dull violet

Pl. fuliginosa

(2) Cells 10-13 mic. in diameter; cell contents violet

Pl. amethystea

(3) Cells up to 15 mic. in diameter; cell contents dull blue or slate color

Pl. crepidinum

107. *Pleurocapsa concharum*. Hansgirg. Phys. und Alg. Mittheil. pl. 1. f. 11-15. 1890. De Toni. Syll. Algar. 5: 122. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1051. 1903.

Colonies minute; tegument moderately thin, colorless; cells 4-17 mic. in diameter, 4-34 mic. in length, spherical, oval, ellipsoid or angular from mutual pressure, united into short, often irregularly dichotomous filaments of four to ten cells each, or into somewhat spherical masses; cell contents very finely granular, dull bluish or olive green; gonidangia 12-20 mic. in diameter, containing 8-32 gonidia; gonidia 3-4 mic. in diameter, spherical.

California. On shells. Mountain Lake. San Francisco. June 1902. (Osterhout and Gardner).

108. *Pleurocapsa caldaria* (Tilden) Setchell in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 18. no. 851. 1901. De Toni. Syll. Algar. 5: 123. 1907.

Tilden. Observations on some West American Thermal Algae. Bot. Gaz. 25: 94. pl. 8. f. 18. 1898; American Algae. Cent. III. no. 283. 1898. (*Protococcus botryoides* f. *caldaria* Tilden); American Algae. Cent. II. no. 198. 1896; Bot. Gaz. 25: 104. pl. 8. f. 21. 1898. (*Chroococcus varius* A. Br.)

Plate III. fig. 1.

Plant mass pale or yellowish green; sheaths thin, homogeneous, hyaline;

cells 4-6 mic. in diameter, spherical, usually solitary; cell contents homogeneous, pale green.

Wyoming. On bottom of spring. Temperature 38° C. Frying Pan Basin, July 1896; on rocks, near vent of geyser, sometimes heated, Norris Geyser Basin. June 1896; with *Microspora amoena thermalis*, lying in overflow from spring. Temperature 41° C. Frying Pan Basin. July 1896. Yellowstone National Park. (Tilden). Forming a green coating on floor of overflow channel. Temperature 49° C. Constant Geyser. Norris Geyser Basin; in acid waters, Green Spring, between Norris Geyser Basin and Beaver Lake. 1897. Yellowstone National Park. (Weed). **California.** Forming an emerald green, rather thick coating on steaming rocks above the "Devil's Kitchen," Geysers. Sonoma County. June 1900. (Setchell and Hunt).

"Clearly a member of the Cyanophyceae and forming a limited number (4) of schizospores (gonidia) which seem to relate it most closely to the genus *Pleurocapsa*."—Setchell.

109. *Pleurocapsa fuliginosa* Hauck. Die Meeresalgen Deutschlands und Oesterreichs. 515. f. 231. 1885. De Toni. Syll. Algar. 5: 122. 1907.

Collins. Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 335. 1891. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 101. 1895. Setchell. Notes on Cyanophyceae. III. Erythaea. 7: 54. 1899. Collins, Holden, Setchell. Phyc. Bor.-Am. Fasc. 15. no. 704. 1900. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900; Phycological Notes of the late Isaac Holden,—I. Rhodora. 7: 172. 1905.

Plate III. fig. 2, 3.

Colonies thin, crustaceous, blackish; families 50-100 mic. in diameter; sheaths colorless; cells 5-20 mic. in diameter, solitary or united in families of twos, fours or eights; cell contents homogeneous, golden yellow, fawn-colored or dull violet.

Massachusetts. Forming a very thin reddish or brownish-black coating on rocks near high water mark. Marblehead. (Collins). **Rhode Island.** (Collins). **Connecticut.** On *Enteromorpha* and stones between tides. Below Yellow Mill Bridge. May, August, November, December. (Holden). In dark patches on stones and woodwork, also epiphytic on *Enteromorpha*, mostly near high water mark. Bridgeport. December 1893. (Holden). **California.** Forming a smooth black covering on smooth rocks, at high water mark in exposed places. Carmel Bay, Monterey County. January 1899. (Setchell and Gibbs). On piles of wharf at the Life Saving Station at the Presidio; on old timbers. Alameda. (Setchell).

Collins states that when the cells cease to divide, the contents change into small round gonidia ("Spores").

110. *Pleurocapsa amethystea* Kolderup-Rosenvinge. Groenlands Havalger. Medd. om Groenland. 3: 967. fig. 57. 1893; Les Algues Marines du Groenland. Ann. Sci. Nat. Bot. VII. 19: 163. fig. 57. 1894. De Toni. Syll. Algar. 5. 121. 1907.

Börgeesen and Jonsson. The Distribution of the Marine Algae of the Arctic Sea and of the northernmost part of the Atlantic. Bot. Faeroes. App. XXV. 1905.

Plate III. fig. 4.

Colonies 45 mic. or more in diameter, somewhat spherical or hemispherical, dark violet in color; cells 10-13 mic. in diameter, hemispherical, angular, depressed or somewhat spherical, at first solitary afterwards aggregated; gonidia 1-2 mic. in diameter.

Greenland. On the surface of *Rhizoclonium riparium validum* m. Littoral zone. Fiskernas. (Rosenvinge). East and west portions. (Börgeesen and Jonsson).

III. *Pleurocapsa crepidinum* Collins. Notes on Algae. III. Rhodora. 136. 1901. De Toni. Syll. Algar. 5: 121. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1157. 1904.

Cells up to 15 mic. in diameter, spherical or by mutual pressure polygonal, often remaining attached in dense masses after dividing; cell contents dull blue or slate color; gonidangia spherical, filled with small gonidia.

Maine. Occurring sparingly in a coating composed of several minute algae, on the woodwork of an old wharf. Otter Creek, Mount Desert. July 1900. (Collins). **Massachusetts.** On Balani and rocks. Magnolia Point. September 1903. (Farlow).

Genus **XENOCOCCUS** Thuret. Ann. Sci. Nat. Bot. VI. 1: 6. 1875.

Colonies disc-shaped or crustaceous, attached; cells somewhat spherical, or angular with rounded apices, crowded, forming a parenchymatous, one-celled layer, later several cells in thickness; tegument colorless or yellowish; cell contents homogeneous, blue-green or violet; reproduction by cell division in three directions or by means of gonidia developed in large peripheral cells; gonidia usually spherical, sometimes 32 developed in a gonidangium.

I Colonies disc-shaped, composed of one layer of cells; tegument surrounding base of cells; cells 3-4 mic. in diameter, 5.5-7 mic. long, pear-shaped.

X. laysanensis

II Colonies spherical, solitary or confluent and completely surrounding the filaments of the host; cells 4-9 mic. in diameter, spherical or flattened.

X. schousboei

III Colonies irregularly expanded, one or several layers in thickness; cells 4-6 mic. in diameter, 4-9 mic. in length.

X. kernerii

112. *Xenococcus laysanensis* Lemmermann Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. pl. 8. f. 11-12. 1905. De Toni. Syll. Algar. 5: 134. 1907.

Plate III. fig. 5, 6.

Colonies epiphytic, disc-shaped, pseudo-parenchymatous, composed of

one layer of cells; tegument hyaline, mucous, surrounding base of cells; cells 3-4 mic. in diameter at apex, 5.5-7 mic. long, pear-shaped, polygonal, crowded; cell contents bluish green.

Hawaii. On marine algae. Laysan Island. 1896-97. (Schauinsland).

113. *Xenococcus schousboei* Thuret in Bornet and Thuret. Notes Algol. 2: 74. pl. 26. f. 1, 2. 1880. De Toni. Syll. Algar. 5: 133. 1907.

Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 612. 1889. **Martindale.** Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 89. 1889. **Collins.** Notes on New England Marine Algae V. Bull. Torr. Bot. Club. 18: 335. 1891. (*Dermocarpa schousboei*). **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 12. no. 554. 1899. **Setchell.** Notes on Cyanophyceae. III. Erythea. 7: 54. 1899. **Collins.** Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 43. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901; Phycological Notes of the late Isaac Holden,—I. Rhodora. 7: 172. 1905. **Collins, Holden, Setchell.** Phyc. Bor.-Am. Fasc. 12. no. 554. 1899.

Plate III. fig. 7.

Colonies spherical, solitary and scattered, or grouped in confluent masses which completely surround the filaments of the host, green or bright blue in color; cells 4-9 mic. in diameter, spherical or flattened by mutual pressure; cell contents light bluish-green.

Maine. (Collins). **Connecticut.** On *Chantransia*, *Sphacelaria*, *Rhodochorton*. Seaside Park; Black Rock; Fresh Pond; June, July, December. (Holden). **Massachusetts.** On *Rhodochorton rothii* and *Rhizoclonium riparium*. Nahant. (Collins). **New Jersey.** Growing on *Lyngbya*. Atlantic City. (Martindale). **California.** On *Calothrix* crustacea, which forms a black velvety coating on smooth rocks near high water mark. Carmel Bay, Monterey County. January 1899. (Setchell and Gibbs). **West Indies.** On *Spermothamnion*. Kingston. Jamaica. July 1900. (Pease and Butler).

114. *Xenococcus kernerii* Hansgirg. Phys. und Alg. Studien. III. pl. 1. f. 19. 1887. De Toni. Syll. Algar. 5: 134. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 20. no. 952. 1902. **Lemmermann.** Ueber die von Herrn Dr. Walter Volz auf seiner Weltreise gesammelten Süßwasseralgen. Abh. Nat. Ver. Brem. 18: Collins. Notes on Algae,—VI. Rhodora 5: 234. 1903. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. 1905.

Plate III. fig. 8.

Colonies irregularly expanded, usually one layer of cells in thickness, crustaceous, about 6-9 mic. in thickness, rarely of several layers, nodulose, rough, 9-30 mic. in thickness; tegument thick, inconspicuously lamellose, colorless; cells usually 4-6 mic. in diameter, 4-9 mic. in length, with rounded apices; cell contents dull blue-green or violet; gonidia about 3 mic. in

diameter, spherical, usually as many as 32 developed in marginal gonidangia.

Massachusetts. On old plants of *Cladophora* in upper tide pool, rocky shore. Cohasset. October 1901. (Collins). **Hawaii.** Ditches and marshes, between Honolulu and Waikiki, Oahu. 1896-97. (Schauinsland).

Genus **HYELLA** Bornet and Flahault. Journ. de Bot. 162. 1888.

Colonies radiately expanded, orbicular, composed of two kinds of filaments; primary filaments horizontal, tangled, twisted, finally becoming a very densely woven felty mass; secondary filaments vertical, developed from primary; branching true; tegument septate, thicker at base of filament, narrower above; cells disconnected, not joined in chains, lower ones short, sometimes divided longitudinally, upper ones longer; reproduction by means of vegetative cells set free from tegument and by means of gonidia formed in gonidangia by successive division of contents.

I Colonies yellowish or olive, at first forming minute patches or dots, later becoming membranaceous or cushion-shaped; erect filaments usually parallel; vegetative cells usually 5-6, sometimes up to 10 mic. in diameter.

H. caespitosa

II Colonies immersed in substance of shell, brownish-gray or bright blue; vegetative cells 5-10 mic. in diameter

H. fontana

115. **Hyella caespitosa** Bornet and Flahault. Note sur deux nouveaux Genres d'Algues perforantes. Journ. de Bot. 2: 162. 1888; Sur quelques Plantes vivant dans le Test Calcaire des Mollusques. Bull. Soc. Bot. France. 36: CLXV. pl. 10. f. 7-9; pl. 11. 1889. De Toni. Syll. Algar. 5: 125. 1907.

Collins. Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 249. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 7. no. 302. 1897. **Setchell.** Notes on Cyanophyceae. III. Erythea. 7: 54. 1899. **Collins.** Preliminary lists of New England plants,—V. Marine Algae. Rhodora. 2: 42. 1900; Phycological Notes of the late Isaac Holden,—I. Rhodora. 7: 172. 1905.

Plate III. fig. 9-II.

Colonies at first forming minute patches or dots, later becoming membranaceous or cushion-shaped, 1-2 mm. wide, yellowish, olive or brownish, for a time mucous, fleshy; erect filaments usually parallel, about 10 mic. in diameter, 100-200 mic. long; tegument simple, gelatinous, colorless; vegetative cells usually 5-6, rarely up to 10 mic. in diameter, somewhat globose or angular, associated in filaments, sometimes irregularly branched; cell contents yellowish-olive, rarely olive to bluish-green.

Canada. In oyster shells. Malpeque, Prince Edward Island. (Faull). **Maine.** In dead shells. Spectacle Island, Penobscot Bay. July 1894; growing in the substance of dead shells. Seal Harbor. (Collins). **Rhode Island.** (Collins). **Connecticut.** In shells. June, August. (Holden). **Massachusetts.** (Collins). **California.** On shells of the eastern oyster (*Ostraea virginiana*). Probably introduced. Bay Farm Island, Alameda. (Setchell).

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116. *Hyella fontana* Huber and Jadin. Sur une nouvelle Algue perforante d'eau douce. Journ. de Bot. 6: 285. pl. 11. 1892. De Toni. Syll. Algar. 5: 126. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 303. 1897.
Collins. Some perforating and other Algae on freshwater shells. Erythea. 5: 95. 1897.

Plate III. fig. 12.

Colonies immersed in substance of shell, dark gray or bright blue, often very dense and then through division of cells having the aspect of *Chroococcus*, or loosely branched; integument almost invisible; vegetative cells 5-10 mic. in diameter, two to four times shorter than wide; gonidangia usually larger and more nearly spherical than the vegetative cells.

Connecticut. In shells in company with *Plectonema terebrans*, *Gomontia holdenii*. Twin lakes, Salisbury, Litchfield county. August 1895. (Setchell and Holden).

"Scattered through the shells, sometimes in rather dense, chroococoidal masses, sometimes in loosely branching filaments."—Collins.

Genus **DERMOCARPA** Crouan.

Ann. Sci. Nat. Bot. IV. 9: 70. 1858.

Colonies usually epiphytic, forming a somewhat indefinite layer; cells spherical, egg-shaped, pear-shaped, oval or oblong, solitary or united in a layer; cell contents usually blue-green or violet; reproduction by means of gonidia formed by simultaneous division of contents of the gonidangium; gonidangia oval or elongate, dissolving at apex to allow the scape of the gonidia.

- I Cells somewhat oval or oblong, not contracted at base to form a stalk.
 - 1 Cell contents blue-green, green, olive or brown *D. prasina*
 - 2 Cell contents rose-colored or violet
 - (1) Cells 4-5 mic. in diameter *D. rosea*
 - (2) Cells 8-28 mic. in diameter *D. violacea*
- II Cells contracted at base to form a stalk.
 - 1 Colonies dark violet-brown; cells 18-25 mic. in diameter, 40-60 mic. in length *D. fucicola*
 - 2 Colonies irregularly outlined; cells 8.5-11 mic. in diameter, 16.5-33.5 mic. in length *D. smaragdinus*
 - 3 Colonies minute; cells 9.5-17 mic. in diameter, 13-25 mic. in length *D. olivaceus*
 - 4 Cells 18-24 mic. in diameter, 17-24 mic. in length *D. leibleiniae*
var. *pelagica*

117. *Dermocarpa prasina* (Reinsch) Bornet and Thuret. Notes Algologique. 2: 73-77. pl. 26. f. 6-9. 1880. De Toni. Syll. Algar. 5: 128. 1907.

Collins. Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 335. 1891; Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 249. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 1. 1895. **Collins.** Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 41. 1900. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. of Calif. Pub. Bot. 1: 182. 1903.

Plate III. fig. 13-15.

Colonies forming a cushion-like expansion of a somewhat spherical mass; sheaths delicate; cells, 4-24 mic. in diameter, 15-30 mic. in length, cylindrical-oblong, club-shaped or spatulate, closely packed, laterally compressed; cell contents homogeneous, deep blue-green or green, becoming bluish, olive or brownish; gonidia arranged in a single row in the small cylindrical gonidangia or in several rows in the larger gonidangia.

Alaska. Abundant on Sphacelaria. From Puget Sound to the Shumagin Islands. (Saunders). **New England.** Grows quite abundantly in spring on the coast, on the older part of the fronds of *Polysiphonia fastigiata*. (Collins). **Maine.** On *Polysiphonia fastigiata*. Near Seal Harbor. (Collins). **Connecticut.** (Collins). **Massachusetts.** On *Polysiphonia fastigiata*, between tides. Little Nahant. April 1891. (Setchell). **Rhode Island.** (Collins).

118. *Dermocarpa* (?) *rosea* (Reinsch) Batters. Marine Algae of Berwick. 141. 1889. Reinsch. Contrib. Algol. et Fungol. 1: 18. pl. 26. f. 4. a-c. 1875. (*Sphaenosiphon roseus* Reinsch). De Toni. Syll. Algar. 5: 130. 1907.

Farlow. Marine Algae of New England. 61. 1881.

Plate III. fig. 16-18.

Colonies 2-5 cm. in diameter, indefinitely expanded; tegument thick, gelatinous, hyaline, surrounding the cells; individual sheaths distinct, somewhat thick; cells 4-5 mic. in diameter, ovoid-elliptical, loosely arranged; cell contents homogeneous, rose-colored.

Newfoundland. On zoophytes. Coast of Labrador. (Reinsch).

119. *Dermocarpa violacea* Crouan. Note sur quelques Algues Marines nouvelles de la rade de Brest. Ann. Sci. Nat. Bot. IV. 9: 70. pl. 3. f. 2. A-D. 1858. De Toni. Syll. Algar. 5: 129. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 556. 1899. **Collins.** Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 41. 1900.

Plate III. fig. 19-21.

Colonies indefinitely expanded or forming patches, rose-red; sheaths thin; cells 8-28 mic. in diameter, oval to wedge-shaped; cell contents rose-red to violet.

New England. On *Enteromorpha intestinalis*. In company with *Lyngbya lutea*, *Amphithrix violacea*, etc. (Collins).

Rhode Island. On *Enteromorpha intestinalis*. Easton's Point, Newport. September 1898. (Simmons).

120. *Dermocarpa fucicola* Saunders in Collins, Holden and Setchell. Phyc. Bor.-Am. no. 801. 1901. De Toni. Syll. Algar. 5: 129. 1907.

Saunders. The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. pl. 46. f. 4, 5. 1901. Setchell and Gardner. Algae of North-western America. Univ. Calif. Pub. Bot. 1: 181. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 26. no. 1251. 1905.

Plate III. fig. 22, 23.

Colonies 2-12 mm. in diameter, forming orbicular or irregular patches which become confluent into irregular masses of indefinite extent, dark violet-brown in color; cells 18-25 mic. in diameter, 40-60 mic. in length, ovate, clavate or spatulate, much narrowed below; gonidia abundant.

Alaska. On *Fucus*. Puget Sound. (Saunders). Canada. North of Oak Bay, Victoria, British Columbia. July 1898. (Tilden). Washington. On *Iridaea laminarioides*. Minnesota reef. San Juan Island. 1898. (Tilden). On *Gelidium*. East Sound, Orcas Island, Washington. (Gardner). On *Fucus*, *Gigartina*, *Odonthalia*, *Amphiroa*, West shore of Whidbey Island, Washington. (Gardner). On *Fucus evanescens macrocephalus*. Near Seattle. June 1899. (Saunders). California. On *Gelidium*, middle littoral. Point Carmel. Monterey County. 3 June 1901. (Setchell).

"The present species occurs along the western coast of North America from Puget Sound to Monterey, California, and grows on all sorts of algae. In its younger and purely vegetative condition, the patches are small and the cells are long and narrow, 4-8 mic. broad and up to 28 mic. high, of equal breadth throughout. Soon they begin to broaden above giving them something of a pear-shape. In this condition they correspond closely to the description and figures given by Sauvageau (1895, p. 8 pl. 7. f. 2, 3.) of his *D. biscayensis*."

"Sauvageau's specimens, which grew on *Sargassum*, do not show conidia, but our specimens show that when the cells proceed to this condition, they become still more swollen in the upper part, while the lower part remains narrow, resembling a sort of stipe. In conidial condition the cells measure 60-65 mic. in height and 25-35 mic. in diameter. * * * We believe that when fruiting specimens can be compared, that this species will be found to be identical with *D. biscayensis* Sauvageau."—Setchell.

121. *Dermocarpa smaragdinus* (Reinsch) nob. Reinsch. Contrib. Algol. et Fungol. 1: 16. pl. 25. f. 4. 1875. De Toni. Syll. Algar. 5: 131. 1907. (*Sphaenosiphon smaragdinus* Reinsch).

Farlow. Marine Algae. New England. 61. 1881

Plate III. fig. 24, 25.

Colonies irregularly outlined; sheaths thick; cells 8.5-11 mic. in diameter, 16.5-33.5 mic. in length, pear-shaped or broadly wedge-shaped, rounded at the apex, prolonged at the base into a hyaline stalk about 2 mic. in diameter; cell contents slightly granular, deep bluish-green (*smaragdinus*).

Canada. On *Polysiphonia*. Lawrence River, Anticosti Island. (Reinsch). Newfoundland. On *Plocamium coccineum*. Labrador. (Reinsch).

122. *Dermocarpa olivaceus* (Reinsch) nob. Reinsch. Contrib. Algol. et Fungol. 1: 17. pl. 27. f. 2. 1875. De Toni. Syll. Algar. 5: 132. 1907. (*Sphaenosiphon olivaceus* Reinsch).

Farlow. Marine Algae New England. 61. 1881.

Plate III. fig. 26, 27.

Colonies minute, expanded or somewhat hemispherical; sheaths thick, lamellose; cells 9.5-17 mic. in diameter, 13-25 mic. in length, pear-shaped or wedge-shaped, broadly rounded at apex, contracted at base; cell contents finely granular.

Canada. On *Ceramium rubrum*. Anticosti Island. (Reinsch). Newfoundland. On *Ceramium rubrum*. Labrador. (Reinsch).

123. *Dermocarpa leibleinia* (Reinsch) Bornet var. *pelagica* Wille. Die Schizophyceen d. Plankton Expedition. 50. pl. 1. f. 1, 2. De Toni. Syll. Algar. 5: 702. 1907.

Plate III. fig. 28.

Sheaths moderately thick, lamellose; cells 18-24 mic. in diameter, 17-24 mic. in length, irregularly pear-shaped, prolonged at the base into a delicate stalk.

Bermudas. (Wille).

Genus **CHAMAESIPHON** Braun and Grunow in Rabenhorst.

Fl. Eur. Algar. 2: 148. 1865.

Plants epiphytic, erect, cylindrical, somewhat filiform, club-shaped or pear-shaped, attached at base, widening upwards to free apex, solitary or aggregated; sheaths present; cell walls very thin; cell contents homogeneous, blue-green, violet or yellow; reproduction by one-celled, non-motile gonidia which are successively cut off from the upper portion of the contents of the gonidangium, gradually escaping from the open apex.

I Gonidangia usually 1-2 celled.

Ch. *incrustans*

II Gonidangia many-celled

Ch. *curvatus*

124. *Chamaesiphon incrustans* Grunow in Rabenhorst. Fl. Eur. Algar. 2: 149. 1865. De Toni. Syll. Algar. 5: 136. 1907.

Möbius. Ueber einige in Portorico gesammelte Süsswasser-und Luft-Algen. Hedwigia. 27: 246. 1888. Harvey. The Fresh-Water Algae of Maine.—III. Bull. Torr. Bot. Club. 19: 124. 1892. Tilden. List of fresh-water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 8. 1908.

Plate III. fig. 29, 30.

Gonidangia 1-2 celled, 1-3 mic. in diameter at the base, 4-8 mic. in diameter at the apex, 7-30 mic. in length, club-shaped or long cylindrical, straight or curved, solitary or densely crowded in groups; tegument colorless, at first closed, later open at apex; cell contents blue-green; gonidia about 2 mic. in diameter.

Maine. Attached to filamentous algae. Spring, College meadow, Orono. (Harvey). **Minnesota.** In tank in Botanical Laboratory. University, Minneapolis, February 1896. (Tilden). **Iowa.** Growing on the surface of an alga, probably an *Oedogonium*. Eagle Grove. Hewitt's Pond. 1904. (Buchanan). **West Indies.** Growing on an *Oedogonium*. In warm springs. Los Baños, near Coamo. Porto Rico. (Sintenis).

125. *Chamaesiphon curvatus* Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus. 4. pl. 1. f. 1, 2. 1878. De Toni. Syll. Algar. 5: 139. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 4. 1878. Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 618. 1905.

Plate III. fig. 31.

Gonidangia many-celled, 3-10 mic. in diameter, 20-100 mic. in length, somewhat cylindrical, more or less curved, rising from a narrow base; tegument colorless; cell contents blue-green.

Hawaii. Among filaments of *Cladophora*. Near Honolulu. Island of Oahu. (Berggren).

Order II. HORMOGONEAE

Plants multicellular, filamentous, attached to a substratum or free-floating; filaments simple or branched, usually consisting of one or more rows of cells within a sheath; reproduction occurs by means of hormogones or resting gonidia.

Family I. Oscillatoriaceae. Filaments frequently branched, containing one or more trichomes; sheaths variable, more or less gelatinous; trichomes consisting of a simple row of cells uniform along their entire length, except for the apical cells which sometimes taper more or less; heterocysts absent; reproduction by means of vegetative division and hormogones.

Family II. Nostocaceae. Sheaths very delicate, mostly confluent, usually not visible; trichomes usually twisting and entangled, consisting of a single row of uniform cells, with heterocysts; reproduction by means of vegetative division, hormogones and gonidia.

Family III. Scytonemaceae. Filaments with a false branch system; sheaths firm and tubular; trichomes consisting of a single row of cells, but not of uniform thickness, with heterocysts; reproduction by means of vegetative division, hormogones and gonidia.

Family IV. Stigonemaceae. Filaments frequently branched; sheaths thick, firm, often irregular; trichomes consisting of one or several rows of cells,

with heterocysts; reproduction by means of vegetative division, hormogones and gonidia.

Family V. **Rivulariaceae**. Filaments tapering from the base to the apex, ending in a multicellular, colorless hair; heterocysts usually present, basal; reproduction by means of vegetative division, hormogones and gonidia.

Family I. OSCILLATORIACEAE

Filaments frequently branched, containing one or more trichomes; sheaths variable, more or less gelatinous; trichomes consisting of a simple row of cells uniform along their entire length; except for the apical cells which sometimes taper more or less; heterocysts absent; reproduction by means of vegetative division and hormogones.

I Sheaths not present.

1 Trichomes straight or nearly so, never forming a regular spiral

- (1) Trichomes cylindrical, usually without sheaths, free; apex of trichome straight or curved
Oscillatoria
- (2) Trichomes cylindrical, without sheaths, united in free-swimming scale-like masses
Trichodesmium

2 Trichomes forming a regular, more or less lax spiral

- (1) Trichomes multicellular
Arthrospira
- (2) Trichomes unicellular
Spirulina

II Sheaths present.

1 Filaments simple or branched; sheaths cylindrical, firm; trichomes single within the sheath; apex of trichome straight

- (1) Filaments simple, more or less agglutinated by their mucous sheaths
Phormidium
- (2) Filaments simple, free, free-floating or forming a matted mass
Lyngbya

- (3) Filaments often branched, forming erect tufts; false branches solitary
Symploca

- (4) Filaments simple; sheaths usually purple or flesh-colored; apical cell not capitate
Porphyrosiphon

2 Filaments frequently branched; sheaths firm, lamellose, transparent or colored; trichomes several within the sheath

- (1) Sheaths more or less mucous, colorless, diffuent; trichomes few within the sheath; apex of trichome capitate
Hydrocoleus

- (2) Filaments prostrate, woven into a solid membranaceous mass, often slightly branched; sheaths solid, always thin, colorless; plants terrestrial or aquatic
Hypheothrix

- (3) Filaments prostrate at the base, above forming erect tufts; sheaths solid, transparent; plants terrestrial
Symplocastrum

- (4) Filaments tufted, often much branched; sheaths transparent or scarcely colored; plants low, aquatic
Inactis

- (5) Filaments branched; sheaths solid, closed at the apex, of various colors; trichomes densely aggregated within the sheath
Schizothrix
- (6) Sheaths wide, transparent or yellowish brown; trichomes very few within the sheath, very loosely aggregated
Dasygloea
- (7) Sheaths mucous, not lamellose, always transparent; trichomes many within the sheath
Microcoleus
- 3 Colonies somewhat spherical, elliptical or spindle-shaped; filaments solitary or aggregated in colonies; sheaths thick, gelatinous
 - (1) Sheaths very thick; trichomes usually single or in scattered fragments
Catagnymene
 - (2) Colonies somewhat spherical; sheaths thick; trichomes curved, radiating
Haliarachne

Genus *OSCILLATORIA* Vaucher. Hist. Conferves. 165. 1803.

Trichomes cylindrical, free, motile, without a sheath or rarely enclosed in a very thin, fragile, mucous sheath, often constricted at the joints; apex of trichome straight, curved, or more or less regularly spiralled, often tapering; outer wall of apical cell often thickened, forming a calyptra.

I Plants living in fresh water, floating; apex of trichome constantly straight, gradually tapering, obtuse, finally capitate; cells somewhat quadrate or shorter than the diameter, never very short.

- 1 Plant mass purple; trichomes 2.2-5 mic. in diameter; cells somewhat quadrate or longer than the diameter *O. prolifica*
- ✓ 2 Plant mass light blue-green; trichomes 4-6 mic. in diameter; cells somewhat quadrate or twice as short as the diameter
O. agardhii

II Plants living in fresh water, sometimes in hot water; trichomes large or very large; apex of trichome straight, curved or spiral, not at all or briefly tapering, obtuse; cells very short.

- 1 Transverse walls never granulated
 - (1) Trichomes 16-60 mic. in diameter; apex of trichome slightly tapering, somewhat capitate, hooked *O. princeps*
 - (2) Trichomes 12-15 mic. in diameter; apex of trichome tapering, capitate, hooked or loosely terebriform *O. proboscidea*
- ✓ 2 Transverse walls frequently granulated
 - (1) Apex of trichome straight
 - A Trichomes 10-20 mic. in diameter, constricted at joints; apex of trichome very briefly tapering, somewhat capitate
O. sancta
 - B Trichomes 11-20 mic. in diameter, not constricted at joints; apex of trichome neither tapering nor capitate
O. limosa

- (2) Apex of trichome spiral, rarely hooked
 - A Trichomes 10-17 mic. in diameter, not constricted at joints; apex of trichome not capitate *O. curviceps*
 - B Trichomes 18-23 mic. in diameter; apex of trichome slightly tapering, obtusely rounded, usually straight *O. major*
 - C Trichomes 9-11 mic. in diameter, slightly constricted at joints, here and there interrupted by inflated, refringent cells; apical cell not capitate *O. ornata*
 - D Trichomes 6-8 mic. in diameter, not constricted at joints, here and there interrupted by inflated, refringent cells; apical cell capitate *O. anguina*
- III Plants living in salt water; trichomes always constricted at joints, rarely straight or spiral throughout; apex of trichome scarcely tapering, very gradually curved, obtuse.
 - 1 Trichomes twisted into a regular spiral *O. bonnemaisonii*
 - 2 Trichomes not spiral, gradually curved in apical portion, rarely straight
 - (1) Plant mass dull red; trichomes 16-24 mic. in diameter *O. miniata*
 - (2) Plant mass olive green; trichomes 17-29 mic. in diameter *O. margaritifera*
 - (3) Plant mass dark olive green; trichomes 7-11 mic. in diameter, straight, fragile *O. nigro-viridis*
 - (4) Plant mass thin, fragile; trichomes 9.6-11.9 mic. in diameter, sometimes spirally coiled, sometimes curved or even nearly straight *O. capitata*
 - (5) Plants epiphytic; trichomes 6-10 mic. in diameter, flexuous, flexible *O. corallinae*
- IV Plants living in fresh water, sometimes in hot water; trichomes straight or curved, not tapering at the apices.
 - 1 Trichomes 8.5 mic. in diameter, straight or slightly flexuous *O. nigra*
 - 2 Trichomes 4-10 mic. in diameter, usually slightly constricted at the joints, often curved at the apices; transverse walls usually furnished with two rows of granules *O. tenuis*
 - 3 Trichomes 2-3 mic. in diameter, not constricted at joints, curved at the apices; transverse walls commonly marked by two protoplasmic granules *O. amphibia*
 - 4 Trichomes 1-1.5 mic. in diameter, straight or rolled in a circinate manner *O. subtilissima*
 - 5 Trichomes 2.3-4 mic. in diameter, curved, very much constricted at joints; transverse walls pellucid, not granulated *O. geminata*
 - 6 Trichomes 2.5 mic. in diameter, especially constricted at joints; transverse walls pellucid *O. minnesotensis*

- 7 Trichomes 3.5-4 mic. in diameter, not constricted at joints; transverse walls pellucid, not granulated *O. chlorina*

- 8 Trichomes .6 mic. in diameter, flexible, elongate, tangled, not constricted at joints *O. angustissima*

V Plants living in fresh water, hot water, rarely in salt water; trichomes tapering, more or less pointed, hooked or flexuous, not entirely spiralled (except *O. chalybea*); cells longer or shorter than the diameter, never very short.

1 Apical cell capitate

- (1) Trichomes 2-3 mic. in diameter; cells longer than their diameter *O. splendida*
 (2) Trichomes 2.5-5 mic. in diameter; cells somewhat quadrate *O. amoena*

2 Apical cell not capitate

(1) Plants living in salt water

- A Trichomes 4.7-6.5 mic. in diameter, flexible, undulating; apex of trichome very gradually tapering, very flexuous *O. subuliformis*
 B Trichomes 4 mic. in diameter, somewhat flexuous, sometimes coiled in a regular circle, very much constricted at joints; apex of trichome tapering, slightly curved, obtuse *O. salinarum*

- C Trichomes 3-5 mic. in diameter, fragile, straight; apex of trichome briefly tapering, hooked or undulating *O. laete-virens*

(2) Plants living in fresh water, often in hot water, rarely in brackish water

- A Trichomes 3-5 mic. in diameter; apex of trichome briefly tapering, very sharply pointed, hooked; cells usually longer than their diameter *O. acuminata* ✓

- B Trichomes 3-4 mic. in diameter; apex of trichome briefly tapering, very sharply pointed, hooked; cells usually shorter than their diameter *O. animalis*

- C Trichomes 4-4.5 mic. in diameter, straight, entangled; transverse walls granulated; cell contents violet or sky-blue *O. violacea*

- D Trichomes 4-6.5 mic. in diameter, here and there interrupted by inflated refringent cells; apex of trichome briefly tapering, hooked or flexuous; cells three times shorter than their diameter *O. brevis* ✓

- E Trichomes 4-7 mic. in diameter; apex of trichome obtuse straight, rarely slightly curved *O. cruenta*

- F Trichomes 4-6 mic. in diameter, slightly constricted at joints; apex of trichome briefly and somewhat obtusely tapering, hooked; cells quadrate or one-half as long as wide *O. formosa*

- G Trichomes 2.5-4 mic. in diameter, constricted at joints; apex of trichome very gradually tapering, hooked or undulating; cells quadrate or longer than the diameter *O. numidica*
- H Trichomes 5.5-8 mic. in diameter, slightly constricted at joints; apex of trichome very gradually tapering, hooked or undulating; cells quadrate or longer than the diameter, very long near the apex *O. cortiana*
- I Trichomes 5.5-9 mic. in diameter, constricted at joints; apex of trichome very gradually tapering, undulating and finally hooked; apical cell obtuse; cells shorter than their diameter *O. okeni*
- J Trichomes 8-13 mic. in diameter, scarcely constricted at joints, sometimes twisted in loose spirals; apex of trichome briefly or gradually tapering and hooked; apical cell obtuse; cells shorter than their diameter *O. chalybea*
- K Trichomes 8-10 mic. in diameter, straight, somewhat constricted at joints; apex of trichome often slightly tapering, obtuse, straight or curved *O. subsalsa*
- L Trichomes 15.5-18.5 mic. in diameter, straight; apex of trichome usually curved, somewhat tapering, obtuse-truncate *O. percursora*

VI Plants living in fresh water, sometimes in hot water; trichomes regularly terebriform in apical portion or forming a spiral throughout their entire length, more or less tapering in the apical portion.

- 1 Trichomes 6-8 mic. in diameter, forming a lax and regular spiral through their entire length, or straight and hooked at the apex; apical cell pointed, not capitate *O. boryana*
- 2 Trichomes 4-6.5 mic. in diameter, flexuous, straight below, loosely spiralled and terebriform above; apical cell obtuse, not capitate *O. terebriformis*

Species not well understood.

O. subtorulosa

126. *Oscillatoria prolifica* (Greville) Gomont. Monographie des Oscillariées. 225. pl. 6. f. 8. 1893. De Toni. Syll. Algar. 5: 149. 1907.

Farlow, Anderson and Eaton. Algae Am.-Bor. exsicc. no. 229. 1889. (*O. diffusa* Farlow). Trelease. The "Working" of the Madison Lakes. Trans. Wis. Acad. Sci. Arts and Letters. 7: 122. pl. 10. 1889. Hauck and Richter. Phytotheka Universalis. no. 477. 1892. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 4. no. 154. 1896. Moore. The Pollution of Water Supplies by Algae. Rhodora. 1: 100. 1899; The causes of the red-brown color in certain Cyanophyceae. Soc. Plant. Morph. and Phys. Sci. N. S. 13: 248. 1901. Hyams and Richards. Notes on *Oscillatoria prolifica* (Greville). Tech. Quart. 14: 302. 1901; 15: 308. 1902; 17: 270. 1904. Olive. Notes on the occurrence of *Oscillatoria prolifica* (Greville) Gomont in the Ice of Pine Lake, Waukesha County, Wisconsin. Trans. Wis. Acad. Sci. 15: 124. 1905.

Plate IV. fig. 1.

Plant mass expanded, floating, purple, when dried becoming lilac; trichomes 2.2-5 mic. in diameter, straight, elongate, flexible, not constricted at joints, when old gradually tapering at apex, obtuse, capitate; cells 4-6 mic. in length, subquadrate or a little longer than wide; apical cell slightly tapering, truncate; calyptra depressed conical; transverse walls frequently granulated; cell contents refringent, coarsely granular.

Massachusetts. Giving a pronounced purple color to the water of Jamaica Pond. 1884. (Farlow). Jamaica Pond. (Moore, Hyams and Richards). Floating freely or forming scum. Jamaica Pond, Boston. (Collins). Forming a floating scum. Jamaica Pond, Jamaica Plain. December 1893. (Burrage). **Wisconsin.** Pine Lake, Waukesha County. August, October 1900. July 1905. (Olive).

127. *Oscillatoria agardhii* Gomont. Monogr. Oscill. 225. 1893. De Toni. Syll. Algar. 5: 149. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 30. no. 1451. 1908.

Plate IV. fig. 2.

Plant mass widely expanded, floating, light blue-green; trichomes 4-6 mic. in diameter, straight throughout entire length, fragile, not constricted at joints, gradually tapering towards the apex, obtuse, capitate; cells 2.5-3.5 mic. in length; apical cell slightly tapering, truncate; calyptra convex; transverse walls granulated; cell contents coarsely granular, pale blue-green.

Missouri. St. Louis. December 1906. (Hus).

128. *Oscillatoria princeps* Vaucher. Hist. Conferves d'eau douce. 190. pl. 15. f. 2. 1803. Gomont. Monogr. Oscill. 226. pl. 6. f. 9. 1903. De Toni. Syll. Algar. 5: 150. 1907.

Harvey. Nereis Boreali-Americana. Part III. 124. 1858. **Mazé and Schramm.** Essai class. Algues Guadeloupe. 17. 1870-77. **Wood.** Contr. Hist. Fresh-Water Algae N. A. 20. 1872. (O. imperator Wood). **Farlow, Anderson and Eaton.** Algae Am.-Bor. exsicc. no. 177. 1877. **Wittrock and Nordstedt.** Algae aq. dulc. exsicc. no. 393. 1877-87. **Rabenhorst.** Algen Europas. no. 2535. 1878. **Wolle.** Fresh-Water Algae U. S. 317. pl. 207. f. 20, 22; pl. 208. f. 3, 4. 1887. **Collins.** Flora of Middlesex County, Massachusetts. 15. 1888. **Möbius.** Ueber einige in Portorico gesammelte Süßwasser- und Luft-Algen. Hedwigia. 27: 248. 1888. **Bennett.** Plants of Rhode Island. 115. 1888. **Trelease.** The "Working" of the Madison Lakes. Trans. Wis. Acad. Sci. Arts and Letters. 7: 125. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 610. 1889. **Mackenzie.** A preliminary list of Algae collected in the neighborhood of Toronto. Proc. of Can. Inst. III. 7: 270. 1890. **Saunders.** Protophyta-Phycophyta Flora of Nebraska. 21. pl. 1. f. 17. 1894. **Tilden.** List of Fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 2. 1895. **Tilden.** Am. Alg. Cent. II. no. 187. 1896; Observations on some West American Thermal Algae. Bot. Gaz. 25: 101. pl. 9. f. 19. 1898; Am. Alg. Cent. III. no. 296. 1898. **Collins.** Preliminary Lists of New England Plants,--V. Marine Algae. Rho-

dora. 2: 42. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901. **Snow**. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. **Setchell and Gardner**. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 182. 1903. **Collins**. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 235. 1905. **Collins, Holden and Setchell**. Phyc. Bor.-Am. Fasc. 26. no. 1253. 1905. **Brown**. Algal Periodicity in certain ponds and streams. Bull. Torr. Bot. Club. 35: 243, 247. 1908. **Buchanan**. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 15. 1908. **Tilden**. American Algae. Cent. VII. Fasc. 1. no. 649. 1909.

Plate IV. fig. 3.

Plant mass dark green or black; trichomes 16-60 mic. in diameter, straight, rigid, fragile when dried, not constricted at joints, slightly tapering, more or less curved and somewhat truncate at apex, somewhat capitate; apical cell convex above; calyptra none; cells 3.5-7 mic. in length; transverse walls never granulated; cell contents finely granular, rarely showing coarser granules.

Canada. High Park, Toronto. (Mackenzie). **United States**. Frequent in ponds and pools from Maine to Florida. (Wolle). **Massachusetts**. Floating on quiet pool. Saugus. (Collins). Cambridge. July 1890. (Farlow). **Rhode Island**. Common. (Bennett). **Connecticut**. Bruce's Brook; Fresh Pond. July, September, October; resting on muddy bottom and floating in considerable masses on the surface of quiet water. Parrott's Pond, Bridgeport. July 1892. (Holden). **New Jersey**. Frequent in ponds and pools. Cape May; Dennisville. (Wolle). **Pennsylvania**. Bethlehem. August 1877. (Wolle). **Alabama**. Auburn. May 1896. (Baker). **Indiana**. In ponds near Bloomington. June to November. (Brown). **Ohio**. In washings of stones and of plants growing in lake. Lake Erie. (Snow). **Wisconsin**. In a brook. Near Madison. (Trelease). **Minnesota**. Bridal Veil Falls, Minneapolis. June 1894. (Tilden). **Iowa**. Fayette. (Fink). Ames. (Bessey). Pond, amid dense growth of Lemna. Eagle Grove. (Buchanan). **Nebraska**. Occasionally found among other algae in the Dismal River region and in many places in the eastern part of the state. (Saunders). **Wyoming**. "Forming a black, thick floating mass in mountain stream at vent of hot spring. Gradually runs out, being replaced by green at a distance of fifty feet from vent. Temperature five feet from spring 42° C.; fifty feet from spring 38° C." Mountains near Nez Perces Creek, Lower Geyser Basin. June 1896; forming dark green velvety mass fringing edge of small mountain creek where a hot spring flows out just underneath the bank. Temperature of water one inch below surface 19° C.; on surface 58° C. Near Emerald Pool. Upper Geyser Basin. July 1896. Yellowstone National Park. (Tilden). **Washington**. In pond on shore of lake. Green Lake, King County. July 1897. (Tilden). **West Indies**. Guadeloupe. (Mazé and Schramm). In river near "Coamo." Porto Rico. (Sentenis). In mats in stream. St. Ann's Bay. Jamaica. March 1893. (Humphrey). Bath, Jamaica. July 1900. (Pease and Butler).

Forma *purpurea* Collins in Collins, Holden and Setchell. Phyc. Bor.-

Am. Fasc. 16. no. 753. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts. Sci. 37: 239. 1901. De Toni. l. c. 152.

Plant mass bright purple; trichomes bright purple.

West Indies. Forming a stratum on a roadside brook, near the baths. Jamaica. July 1900. (Pease and Butler).

129. *Oscillatoria proboscidea* Gomont. Monogr. Oscill. 229. pl. 6, f. 10, 11. 1893. De Toni. Syll. Algar. 5: 152. 1907.

Crouan in Mazé and Schramm. Essai Class. Algues Guadeloupe. 17. 1870. (*O. antillarum* Crouan). **Wood.** Contr. Hist. Fresh-Water Algae North America. 20. pl. 2. f. 5. a, b. 1872. (*O. neglecta* Wood). **Collins.** Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 289. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 24. no. 1159. 1904. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 182. 1903.

Plate IV. fig. 4.

Plant mass dark green; trichomes 12-15 mic. in diameter, straight or somewhat flexuous, here and there spiral, not constricted at joints, sometimes mixed with other *Oscillatorias*; apex of trichome briefly tapering, capitate, almost truncate, curved or loosely spiralled; apical cell showing a convex, slightly thickened outer membrane; cells 2-4 mic. in length; transverse walls never granulated; cell contents finely granular.

Alaska. In a small pond of fresh water. Glacier Valley, Unalaska. 1899. (Lawson). **Pennsylvania.** In shallow ditches along railroad track. Near Manayunk. (Wood). **California.** On rocks in stream. North Berkeley. March 1901. (Gardner). **West Indies.** Guadeloupe. (Mazé and Schramm). In a pool by "Wag Water" and in stream from reservoir. Castleton, Jamaica. April 1893. (Humphrey).

130. *Oscillatoria sancta* Kuetzing. Tab. Phyc. 1: 30. pl. 42. f. 7. 1845-1849. Gomont. Monogr. Oscill. 229. pl. 6. f. 12. 1893. De Toni. Syll. Algar. 5: 153. 1907.

Tilden. Am. Alg. Cent. I. no. 73. 1894. (*O. limosa*). **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 10. no. 500. 1898. **Setchell.** Notes on Cyanophyceae.—III. Erythea. 7: 53. 1899. **Tilden.** Am. Alg. Cent. V. no. 495. 1901; Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 166. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 182. 1903.

Plate IV. fig. 5.

Plant mass dark lead-colored, becoming violet when dried and tinting paper a beautiful violet; trichomes 10-20 mic. in diameter, elongate, flexible, straight or curved, fragile when dried, constricted at joints; apex of trichome very briefly tapering, somewhat capitate, straight; cells 2.5-6 mic. in length; wall of apical cell strongly thickened into a conspicuous convex calyptra; transverse walls marked with densely crowded coarse granules; cell contents olive green or mouse-colored.

New York. At bottom of warm spring. Lebanon Springs. (Harrison).
Minnesota. Growing in somewhat dry sheets on sides of wooden tables in greenhouse. St. Paul. November 1894. (Tilden). **Washington.** In a small pond of fresh water. Port Townsend. (Gardner). **California.** At bottom of cold stream. Near Oakland. (Setchell). On earth among flower pots in conservatories. University of California. Berkeley. (Nott). **Hawaii.** Forming a reddish-brown skin on wet sides of cliff. Falls four miles from mouth of river. Waialuka River. Hilo, Island of Hawaii. July 1900; on muddy sides of sewer ditch. Kealea Plantation, Kauai. July 1900. (Tilden).

Var. *caldariorum* (Hauck) Lagerheim. Algologiska Bidrag. Bot. Notiser. 49. 1886. Gomont. l. c. 230. 1893. De Toni. l. c. 154. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1055. 1903. Trichomes 10-14 mic. in diameter.

California. On moist ground in conservatory. Golden Gate Park, San Francisco. December 1902. (Gardner).

Var. *aequinotialis* Gomont. l. c. 230. 1893. De Toni. l. c. 154. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 11. no. 502. 1898; Fasc. 28. no. 1352. 1907.

Trichomes 15-20 mic. in diameter.

Massachusetts. In stagnant water in claypit. West Medford. September 1906. (Collins). **California.** Forming dark brown patches on damp soil in greenhouses. University of California, Berkeley. 1896. (Nott).

131. *Oscillatoria limosa* Agardh. Disp. Alg. Suec. 35. 1812. Gomont. Monogr. Oscill. 230. 1893. De Toni. Syll. Algar. 5: 154. 1907.

Wolle. Fresh-Water Algae. U. S. 313. pl. 206. 1887. Collins. Algae of Middlesex County, Massachusetts. 15. 1888; Marine Algae of Nantucket. 4. 1888. Martindale. Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. (*O. froelichii* Kg.). Mackenzie. A preliminary list of Algae collected in the neighborhood of Toronto. Proc. of Can. Inst. III. 7: 270. 1890. Jelliffe. A preliminary list of the plants found in the Ridgewood Water Supply of the City of Brooklyn, King's County, N. Y. Bull. Torr. Bot. Club. 20: 243. 1893; A preliminary report upon the microscopical organisms found in the Brooklyn water supply. Brook. Med. Journ. 7: 602. 1893; A further contribution to the microscopical examination of the Brooklyn water supply. Brook. Med. Journ. 8: 592. 1894. Tilden. American Algae. Cent. I. no. 72. 1894. Collins. Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 248. 1894. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 21. 1894. Tilden. List of Freshwater Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 6. no. 253. 1897. Setchell. Notes on Cyanophyceae. —III. Erythea. 7: 53. 1899. Collins. Preliminary lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. Tilden. American Algae. Cent. VI. no. 592. 1902. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. (*O. froehlichii* Kuetz.).

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 183. 1903. **Collins.** Phycological Notes of the late Isaac Holden. —II. Rhodora. 7: 235. 1905. **Riddle.** Brush Lake Algae. Ohio Nat. 5: 268. 1905. **Brown.** Algal Periodicity in certain ponds and streams. Bull. Torr. Bot. Club. 35: 243, 247. 1908. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 31. no. 1503. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 14. 1908. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 648. 1909.

Plate IV. fig. 6.

Plant mass dark blue-green; trichomes 11-20 mic. in diameter, crowded, straight (in dried specimens rigid and fragile), not constricted at joints; apex of trichome straight, not at all or scarcely tapering, not capitate; apical cell showing a convex, somewhat thickened outer wall; cells 2-5 mic. in diameter; transverse walls frequently granulated; cell contents blue-green or olive.

Canada. Humber River, Toronto. (Mackenzie). **United States.** (Wolle). **Maine.** In fresh water. Mount Desert Island. (Holden). **Massachusetts.** Newton. (Farlow). Charles River, Newton; on wharves, Nantucket; in claypit, Glenwood, Medford, April 1892. (Collins). **Rhode Island.** (Collins). **Connecticut.** On sandy bottom and floating in fresh water ditch. May 1892; Berkshire Mill Pond (brackish), Bridgeport, May 1894; stream, Stratford; Great Falls of the Housatonic; ditch below Factory Pond, floating and attached to plants; Berkshire Mill Pond; forming a dark purple stratum on plants in running water, Pequonnock River, below Factory Pond Dam. (Holden). **New York.** Brooklyn water supply. December and February. (Jelliffe). **New Jersey.** Stapleton and Tomkinsville, Staten Island. (Pike). Frequent, on wet earth. (Wolle). **Texas.** 1902. (Fanning). **Ohio.** Brush Lake, Champaign County. 1902. (Riddle). In washings of stones and of plants growing in the lake. Put-in-Bay, Lake Erie. (Snow). **Indiana.** Faris Pond, Fees Pond, Monon Pond, Jordan Branch. Near Bloomington. December until May. (Brown). **Minnesota.** Growing mostly beneath surface of water. Current very swift. State Fish Hatcheries, St. Paul. September 1894. (Tilden). In rapidly running water, forming brown coating on decayed leaves. Minnehaha Creek, above the Falls, Minneapolis. October 1901. (Hone). **Iowa.** In a sulphur spring. Iowa Falls. June 1904. (Gardner). Very common. Iowa City. (Hobby). Fayette. (Fink). On damp earth, forming a thin coating. Ames. (Bessey, Buchanan). Moist earth; floating in Hewitt's Pond, Eagle Grove; on moist soil in the greenhouse. Ames. (Buchanan). **Nebraska.** Common on damp earth, forming a blue-green coating. (Saunders). **Washington.** Floating on ditches of slightly brackish water. La Conner, Skagit County; Whidbey Island. (Gardner).

Var. badia Tilden. American Algae. Cent. II. no. 188. 1896. De Toni. Syll. Algar. 5: 157. 1907.

Plant mass forming a thin scum on rocks, afterwards breaking loose and floating on surface of water, brownish; trichomes 9.5 mic. in diameter; cells 5-9.5 mic. in length; cell contents drab or light brown.

Minnesota. On rocks. Grand Marais, Lake Superior. July 1896. (Elftman).

132. *Oscillatoria curviceps* Agardh. Syst. Alg. 68. 1824. Gomont. Monogr. Oscill. 233. pl. 6. f. 14. 1893. De Toni. Syll. Algar. 5: 157. 1907.

Mazé and Schramm. Essai class. Algues Guadeloupe. 16. 1870-77. (*O. subsalsa dulcis*). **Dame and Collins.** Flora of Middlesex County, Massachusetts. 15. 1888. (*O. froelichii viridis*). **Tilden.** American Algae. Cent. II. no. 189. 1896. **Bessey, Pound and Clements.** Additions to the reported Flora of the State. Bot. Surv. Neb. 5: 13. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 27. no. 1305. 1906.

Plate IV. fig. 7.

Plant mass light or dark blue-green; trichomes 10-17 mic. in diameter, elongate, straight below, above curved or twisted into a loose spiral, not constricted at joints; apex of trichome not or scarcely tapering, not capitate; cells 2-5 mic. in length; outer wall of apical cell convex, sometimes slightly thickened; transverse walls sometimes marked by two rows of granules; cell contents uniformly granular or showing larger granules.

United States. (Wolle, Farlow). **Massachusetts.** Medford claypits. (Collins). **Nebraska.** On moist soil, greenhouse. Lincoln. (Bessey). **Colorado.** On surface of slow-flowing water in swamp. Five miles south-east of Fort Collins. July 1896. (Cowen). **California.** Outlet of Lake Temescal, Oakland. July 1905. (Gardner). **West Indies.** (Crouan).

133. *Oscillatoria major* Vaucher. Hist. Conferves d'eau douce. 192. pl. 15. f. 3. 1803. De Toni. Syll. Algar. 5: 157. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. **West.** The Freshwater Algae of Maine. Journ. of Bot. 29: 356. 1891.

Plant mass membranaceous, mucous, blue-green, lead-colored or dark steel-blue; trichomes 18-23 mic. in diameter, straight, often arranged longitudinally in narrow bundles; apex of trichome somewhat tapering, obtusely rounded, usually straight; cells 4.5-6 mic. in length; transverse walls granulated on both sides.

Maine. Scarbro'. (Aubert). **New Jersey.** In sluggish and stagnant waters. (Wolle). **Pennsylvania.** Borders of ponds and pools. (Wolle).

134. *Oscillatoria ornata* Kuetzing. Tab. Phyc. 1: 30. pl. 42. f. 9. 1845-1849. Gomont. Monogr. Oscill. 234. pl. 6. f. 15. 1893. De Toni. Syll. Algar. 5: 158. 1907.

Plate IV. fig. 8.

Plant mass dark blue-green; trichomes 9-11 mic. in diameter, slightly constricted at joints, here and there interrupted by inflated and refringent cells, straight below, above twisted into a loose spiral, slightly and gradually tapering; apex of trichome not capitate, obtuse; apical cell convex above; calyptra none; cells 2-5 mic. in length; transverse walls frequently granulated.

Massachusetts. (Collins).

135. *Oscillatoria anguina* Bory. Dict. class. d'hist. nat. 12: 467. 1827.
Gomont. Monogr. Oscill. 234. pl. 6. f. 16. 1893. De Toni. Syll.
Algar. 5: 159. 1907.

Tilden. American Algae. Cent. I. no. 74. 1894; List of Fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895.
Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901.
Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1052. 1903.

Plate IV. fig. 9.

Plant mass dark blue-green; trichomes 6-8 mic. in diameter, not constricted at joints, frequently interrupted by inflated and refringent cells, straight below, above terebriform, gradually tapering; apex of trichome capitate, obtuse; outer wall of apical cell slightly thickened; cells 1.5-2.5 mic. in length; transverse walls sometimes granulated.

Minnesota. On moist earth. State Fish Hatcheries, St. Paul, August 1894; in stream formed by springs, Second Creek, Lake City, Wabasha County. September 1894. (Tilden). California. Floating among Chara in a small stream. Near Richmond, Contra Costa County. November 1902. (Gardner). West Indies. In still water. Roaring River, near St. Ann's Bay, Jamaica. March 1893. (Humphrey).

136. *Oscillatoria bonnemaisonii* Crouan in Desmazieres. Pl. Crypt. France. II. no. 537. 1858. Gomont. Monogr. Oscill. 235. pl. 6. f. 17, 18. 1893. De Toni. Syll. Algar. 5: 159. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877; Fresh-Water Algae. U. S. 316. pl. 207. f. 16, 17. 1887. West, W. Jun. Some Oscillarioideae from the Plankton. Journ. of Bot. 37: 337. 1899. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 183. 1903. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. 1905. Tilden. American Algae. Cent. VII. Fasc. 1. no. 647. 1909.

Plate IV. fig. 10.

Trichomes 18-36 mic. in diameter, forming loose and regular spirals, elongate, flexible, somewhat constricted at joints; apex of trichome neither tapering nor capitate; apical cell with convex outer wall, not capitate; calyptra none; cells 3-6 mic. in length; transverse walls not granulated; cell contents finely granular, uniformly strewn with larger granules.

Pennsylvania. Wet soil, recently inundated. (Wolle). Washington. In salt marshes. Whidbey Island. (Gardner). West Indies. In plankton. (Murray and Blackman). Hawaii. On marine algae. Laysan. 1896-97. (Schauinsland). Mixed with other algae, floating in lagoon on beach. Seaconnot, near Hilo, Island of Hawaii. July 1900. (Tilden).

137. *Oscillatoria miniata* Hauck. Die Meeresalgen Deutschlands und Oesterreichs. 508. 1885. Gomont. Monogr. Oscill. 236. 1893. De Toni. Syll. Algar. 5: 160. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 16. 1870-1877. Murray. Catalogue of the Marine Algae of the West Indian Region. Journ.

of Bot. 27: 261. 1889. **West.** Some Oscillarioideae from the Plankton. Journ. of Bot. 37: 337. pl. 400 a. 1899.

Plant mass dull red; trichomes 16-24 mic. in diameter, straight, constricted at joints (?), apex of trichome briefly tapering, obtuse, capitate; apical cell showing a slightly convex calyptra; cells 7-11 mic. in length; cell contents homogeneous or slightly granular, pale or dark red.

West Indies. (Mazé and Schramm). In plankton. (Murray and Blackman.)

138. *Oscillatoria margaritifera* Kuetzing. Tab. Phyc. 1: 31. pl. 43. f. 10. 1845. Gomont. Monogr. Oscill. 236. pl. 6. f. 19. 1893. De Toni. Syll. Algar. 5: 161. 1907.

Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900.

Plate IV. fig. 11.

Plant mass black; trichomes 17-29 mic. in diameter, straight, constricted at joints, curved gradually and for some distance from the end; apex of trichome slightly tapering, obtuse; apical cell capitate; calyptra slightly convex; cells 3-6 mic. in diameter; transverse walls lined with granules; cell contents olive green.

Massachusetts. Northern part of state. (Collins). **West Indies.** Guadeloupe. (Mazé).

139. *Oscillatoria nigro-viridis* Thwaites in Harvey. Phyc. Brit. Syn. XXXIX. no. 375. pl. 251. A. 1846-1851. Gomont. Monogr. Oscill. 237. pl. 6. f. 20. 1893. De Toni. Syll. Algar. 5: 161. 1907.

Farlow. Marine Algae of New England. 33. 1881. (*O. limosa chaelybea*). **West.** Some Oscillarioideae from the Plankton. Journ. of Bot. 37: 337. 1899. **Collins.** Preliminary lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 22. no. 1056. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 183. 1903.

Plate IV. fig. 12.

Plant mass very dark olive green; trichomes 7-11 mic. in diameter, moderately long, somewhat straight, fragile, constricted at joints, curved gradually and for some distance from the end; apex of trichome tapering, obtuse; apical cell somewhat capitate, with convex and slightly thickened outer wall; cells 3-5 mic. in length; transverse walls granulated; cell contents pale green or olive.

Maine. Forming a slimy layer on piles. Eastport. (Farlow). Forming a black, very thin film on muddy beams under old tide mill. Harpswell. July 1902. (Collins). **Massachusetts.** Northern part of state. (Collins). **Washington.** In salt marshes. Whidbey Island. (Gardner). Seattle. (Foster). **West Indies.** In plankton. (Murray and Blackman).

140. *Oscillatoria capitata* W. West Jun. Some Oscillarioideae from the Plankton. Journ. of Bot. 37: 337. pl. 400 a. 1899. De Toni. Syll. Algar. 5: 162. 1907.

Plate IV. fig. 13-15.

Trichomes 9.6-11.9 mic. in diameter, free or forming a delicate fragile mass, at times spirally coiled and twisted, or curved, or even nearly straight, slightly constricted at joints; apex of trichome slightly tapering; cells 4-8.5 mic. in length; apical cell 6.9-9.1 mic. in diameter, 6.7-8.1 mic. in length, at constriction 3.6-8 mic. in diameter; calyptra more or less convex and closely appressed; transverse walls not granulated; cell contents homogeneous or somewhat granular.

West Indies. Lat. 23° 44' N.; long. 45° 30' W. (Murray and Blackman).

Wille considers this species to be a variety of *Catagnymene spiralis* Lemmermann.

141. *Oscillatoria corallinae* Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 356. 1890; Monogr. Oscill. 238. pl. 6. f. 21. 1893. De Toni. Syll. Algar. 5: 162. 1907.

Collins. Preliminary lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901; Phycological Notes of the late Isaac Holden.—I. Rhodora. 7: 172. 1905. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. 1905.

Plate IV. fig. 16.

Trichomes gregarious, forming a delicate coating on larger algae, 6-10 mic. in diameter, very long, flexuous, at times contorted, contracted at joints, curved gradually and for some distance from the end; apex of trichome scarcely tapering; cells 2.7-4 mic. in length; transverse walls not granulated; cell contents granular; apical cell somewhat capitate, with convex, slightly thickened outer wall.

Connecticut. On *Gelidium*. Woodmont; on *Enteromorpha*, below Yellow Mill Bridge, September. (Holden). **West Indies.** In a pellicle on coral rock. Port Antonio. March 1893. (Humphrey). Among other algae, near Kingston, Duerden. (Collins). **Hawaii.** Washings from marine algae. Laysan Island. (Schauinsland).

142. *Oscillatoria nigra* Vaucher. Hist. Conferves d'eau douce. 192. no. 3. pl. 15. f. 4. 1803. De Toni. Syll. Algar. 5: 164. 1907.

Collins. Algae of Middlesex County, Massachusetts. 15. 1888. **Bennet.** Plants of Rhode Island. 115. 1888. **West.** The Freshwater Algae of Maine. 27: 207. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. **Anderson.** List of California Marine Algae, with notes. Zoe. 2: 217. 1891. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 14. 1908.

Plant mass more or less compact, somewhat membranaceous, usually floating, lead-colored or dark olive green, glistening; trichomes 8.5 mic. in diameter, straight or slightly flexuous; apex of trichome tapering, obtusely rounded; apical cell usually straight, somewhat beak-like, bearded,

rarely slightly curved; cells equal in length to the diameter, after division shorter; transverse walls very distinctly granulated; cell contents finely granular, pale olive.

United States. (Bailey). **Maine.** (West). **Massachusetts.** Newton. (Farlow). Malden. (Collins). **Rhode Island.** Common. (Bennett). **New Jersey.** Frequent in wet places. (Wolle). **Iowa.** Usually floating free in stagnant water. Iowa City. (Hobby). Ames. (Bessey, Buchanan). **California.** On moist cliffs above high tide. Common. (Anderson).

143. *Oscillatoria tenuis* Agardh. *Algarum*. Decades. 2: 25. 1813. Gomont. Monogr. Oscill. 240. pl. 7. f. 23. 1893. De Toni. Syll. Algar. 5: 166. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 16. 1870-77. **Rabenhorst.** Algen Europa's. no. 2536. 1878. (*O. cortiana*). **Dickie.** On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3. 236. 1883. **Wolle.** Fresh-Water Algae U. S. 313. pl. 206. f. 14. 1887. **Bennett.** Plants of Rhode Island. 115. 1888. **Collins.** Algae of Middlesex County, Massachusetts. 15. 1888. (*O. viridis*). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. **Rosenvinge.** Les Algues Marines du Groenland. Ann. Sci. Nat. Bot. VII. 19: 162. 1894. **Tilden.** American Algae. Cent. I. no. 75. 1894. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 21. pl. 1. f. 16. 1894. **Tilden.** List of Fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 3. no. 102. 1895. **Tilden.** American Algae. Cent. II. no. 190. 1896. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896. **Rosenvinge.** Deuxième Mémoire sur les Algues Marines du Groenland. Medd. om Groenland. 20: 121. 1898. **Tilden.** List of Fresh-water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 29. 1898. Observations on some West American Thermal Algae. Bot. Gaz. 25: 101. pl. 9. f. 20. 1898. **Collins.** Preliminary Lists of New England Plants,—V. Marine Algae. Rhodora. 2: 42. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901. **Snow.** The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 393. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 183. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905. **Börjesen and Jonsson.** The distribution of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic. Botany of the Faeroes. Appendix. XXV. 1905. **Brown.** Algal periodicity in certain ponds and streams. Bull. Torr. Bot. Club. 35: 242, 247. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 14. 1908.

Plate IV. fig. 17, 18.

Plant mass thin, bright, rarely dull blue-green; trichomes 4-10 mic. in diameter, straight, fragile, usually slightly constricted at joints; apex of trichome straight or curved, neither tapering nor capitate; apical cell convex, showing a slightly thickened outer wall; cells 2.6-5 mic. in length;

transverse walls usually furnished with two rows of granules; cell contents pale blue-green.

Arctic Regions. Fresh water. 82° 27' lat. N. (Dickie). **Greenland.** Western part, south of 61° lat. N. (Rosenvinge). Western part. (Börgesen and Jonsson). **New Hampshire.** On mosses. Mill Brook, Shelburne. (Farlow). **Massachusetts.** Newton. (Farlow). Malden and Reading. On rocks and trunks of trees. (Collins). **Rhode Island.** Providence. (Lathrop). **New Jersey.** In stagnant waters; frequent. (Wolle). (Collins). **Connecticut.** Bruce's Brook. October 1890; floating in pool below Factory Pond; Housatonic River, on wall of quartz mill; Fresh Pond; Pequonnock River, Bridgeport. (Holden). **New York.** In deep pool. Ithaca flats. April 1895. (Atkinson). **Pennsylvania.** Dripping, mossy rocks, pools, margins of pools, or free swimming; in hot water. (Wolle). **Ohio.** In plankton. Put-in-Bay, Lake Erie. (Snow). **Indiana.** "Three different species of *Oscillatoria* appeared in considerable abundance in the ponds and streams under observation. These were *Oscillatoria tenuis*, *O. limosa* and *O. princeps*. Some other species were noticed but they did not persist any length of time. *O. tenuis* was the most abundant form both in quantity and distribution. It was abundant in stream no. 1. (Jordan Branch), especially in the lower part, and in the smaller of the water-works ponds during the greater part of the year. In stream no. 1 it grew on the stones in the bottom, forming a tolerably dense stratum. A similar stratum formed on the rocks at the outlet of pond no. 4 (Monon Pond) whenever sufficient water flowed over the spillway to keep them wet. Around the edge of the smaller of the water-works ponds there was usually a stratum covering the bottom in the shallow water. Whenever sufficient oxygen collected in the meshes of a mass it was loosened and floated on the surface."—Brown. **Minnesota.** Lining sides of tanks in Zoological Laboratory, University of Minnesota, Minneapolis. November 1894. (Tilden). In arm of Mississippi River (old channel). St. Paul Park. October 1897. (Freeman). **Nebraska.** Rocks, pools, margins of ponds, or floating free; common throughout the state. (Saunders). **Wyoming.** In small mountain spring in a bog, together with moss and water cress. Valley of Nez Perces Creek, Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden). **Washington.** Floating in slightly brackish water in a ditch. La Conner, Skagit County. (Gardner). "Agrees well with *O. tenuis*, except that it is hardly at all torulose."—Setchell. **West Indies.** Guadeloupe. (Mazé and Schramm). Bath. July 1900. (Pease and Butler).

Var. *natans* (Kuetzing) Gomont. l. c. 241. De Toni. l. c. 168.

Wolle and Martindale. Algae. Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. (*O. natans* Kg.). **Tilden.** American Algae. Cent. I. no. 76. 1894; List of Fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. **Snow.** The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 393. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. *Rhodora*. 7: 236. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 25. no. 1207. 1905; Fasc. 26. no. 1252. 1905.

Trichomes 6-10 mic. in diameter.

Connecticut. Bruce's Brook, Bridgeport. October, December. (Holden).
New Jersey. Fresh water ponds, frequent. (Wolle). **Ohio.** Plankton.
Put-in-Bay, Lake Erie. (Snow). **Wisconsin.** Floating in tanks. Trout
mere. Osceola. October 1894. (Tilden). **California.** In a stream at the
outlet of Lake Chabot, San Leandro, Alameda County. May 1903. (Gardner).

Var. *tergestina* (Kuetz.) Rabenhorst. Fl. Eur. Algar. 2: 102. 1865.
Gomont. Monogr. Oscill. 241. 1893. De Toni. Syll. Algar. 5: 168. 1907.

Tilden. American Algae. Cent. IV. no. 400. 1900. Collins, Holden
and Setchell. Phyc. Bor.-Am. Fasc. 14. no. 651. 1900. Tilden. American
Algae. Cent. VI. no. 593. 1902. Setchell and Gardner. Algae of North-
western America. Univ. Calif. Pub. Bot. 1: 183. 1903.

Trichomes 4-6 mic. in diameter.

Rhode Island. Forming small patches of a verdigris-green color in
warm water of escape from a steam boiler. Berkeley. March 1894. (Setchell
and Osterhout). **Minnesota.** In polyzoan colony. Mississippi River, St.
Paul. 1898. (Freeman). In pool. Lincoln Park, Duluth. August 1901. (Til-
den). **Washington.** In pool of fresh or slightly brackish water. Whidbey
Island; Seattle. (Gardner).

144. *Oscillatoria amphibia* Agardh. Aufzählung einiger in den österreich-
ischen Ländern gefundenen neuen Gattungen und Arten von Algen.
Flora. 10: 632. 1827. Gomont. Monogr. Oscill. 241. pl. 7. f. 4, 5.
1893. De Toni. Syll. Algar. 5: 169. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877.
(*O. tenerrima* Kg.); Fresh-Water Algae U. S. 310. pl. 205. f. 3. 1887.
Bessey. Miscellaneous additions to the Flora of the State, and new or
noteworthy species from various localities. Bot. Surv. Nebraska. 46. 1893.
Rosenvinge. Les Algues Marines du Groenland. Ann. Sci. Nat. Bot. VII.
19: 163. 1894. Collins. Algae. Rand and Redfield's Flora of Mount Desert
Island, Maine. 248. 1894. Saunders. Protophyta-Phycophyta. Flora of Ne-
braska. 20. pl. 2. f. 18. 1894. Collins. Algae. Flora of the Blue Hills,
Middlesex Fells, Stony Brook and Beaver Brook Reservations of the
Metropolitan Park Commission, Massachusetts. 127. 1896. Rosenvinge.
Deuxième Mémoire sur les Algues Marines du Groenland. Medd. om Groen-
land. 20. 121. 1898. Tilden. Observations on some West American
Thermal Algae. Bot. Gaz. 25: 102. pl. 9. f. 21. 1898. Collins, Holden and
Setchell. Phyc. Bor.-Am. Fasc. 15. no. 705. 1900. Collins. Preliminary
Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900.
Bessey, Pound and Clements. Additions to the reported Flora of the State.
Bot. Surv. Nebraska. 5: 13. 1901. Tilden. American Algae. Cent. VI.
no. 594. 1902. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm.
Bull. for 1902. 22: 392. 1903. Collins. Phycological Notes of the late
Isaac Holden.—II. Rhodora. 7: 235. 1905. Börgesen and Jonsson. The
distribution of the Marine Algae of the Arctic Sea and of the northern-
most part of the Atlantic. Botany of the Faeroes. Appendix. XXV. 1905.

Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 14. 1908. **Tilden.** American Algae. Cent. VII. Fasc. I. no. 646. 1909.

Plate IV. fig. 19, 20.

Plant mass thin, of a beautiful blue-green color; trichomes 2-3 mic. in diameter, straight or curved, fragile, not constricted at joints, curved gradually at the end; apex of trichome neither tapering nor capitate; apical cell rotund above; calyptra none; cells 4-8.5 mic. in length; transverse walls commonly marked by two protoplasmic granules; cell contents pale blue-green.

Greenland. Western part at 60° N. lat. (Rosenvinge). Eastern and western parts. (Börjesen and Jonsson). **United States.** Coating wood subject to hot waste water from steam engines. Temperature about 110° F. (Wolle). **Maine.** In fresh water. (Holden). **Massachusetts.** On rocks and trunk of trees. (Collins). **Connecticut.** On muddy bottom of Bruce's Brook, Bridgeport. (Holden). **Texas.** 1902. (Fanning). **Ohio.** Plankton. Put-in-Bay, Lake Erie. (Snow). **Minnesota.** In pool, Oatka Beach, Minnesota Point, Duluth. August 1901. (Tilden). **Iowa.** In stagnant water and on soil. Fayette. (Fink). Effluent of the filter beds of the college sewage disposal plant; on the soil in greenhouse, Ames; pond, Eagle Grove. (Buchanan). **South Dakota.** Floating in large dark blue-green masses on surface of water. Lake Hendricks. August 1898. (Allen and Saunders). **Nebraska.** In Salt Creek; in cultures. Lincoln. (Bessey). In ditches and ponds among other algae. (Saunders). **Wyoming.** Lining channel of spring. Above Beehive Geyser, Upper Geyser Basin, Yellowstone National Park. 1897. (Weed). **Washington.** In mud at bottom of ponds. Whidbey Island. (Gardner).

145. *Oscillatoria subtilissima* Kuetzing. Tab. Phyc. 1: 27. pl. 38. f. 7. 1845-49. De Toni. Syll. Algar. 5: 171. 1907.

Bennett. Plants of Rhode Island. 115. 1888. **Snow.** The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903.

Trichomes 1-1.5 mic. in diameter, solitary or scattered, rarely associated in a yellowish-green mass, slender, straight or rolled in a circinate manner; cell walls inconspicuous; cell contents homogeneous, yellowish-green.

Rhode Island. Common. (Bennett). **Ohio.** Plankton. Put-in-Bay, Lake Erie. (Snow).

146. *Oscillatoria geminata* Meneghini. Conspectus Algologiae euganeae. 9. 1837. Gomont. Monogr. Oscill. 242. pl. 7. f. 6. 1893. De Toni. Syll. Algar. 5: 172. 1907.

Tilden. American Algae. Cent. II. no. 191. 1896; List of Fresh-water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 28. 1898; Observations on some West American Thermal Algae. Bot. Gaz. 25: 102. pl. 9. f. 22. 1898; American Algae. Cent. VI. no. 595. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 183. 1903.

Plant mass dull yellowish-green; trichomes 2.3-4 mic. in diameter,

curved, sometimes rolled, somewhat fragile, very much constricted at joints; apex of trichome straight or curved, neither tapering nor capitate; apical cell rotund; calyptra none; cells of unequal length, 2.3-16 mic. long; transverse walls pellucid, not granulated; protoplasm containing a few large, refringent granules.

Minnesota. In arm of Mississippi River (old channel), St. Paul Park. October 1897. (Freeman). **Montana.** In hot water. Lo Lo Hot Springs, Lo Lo. September 1898. (Griffiths). **Wyoming.** Covering bottom of creek in swift current. Temperature 47.5° C. Near Upper Geyser Basin, Yellowstone National Park. July 1896. (Tilden). **Washington.** On mud by the roadside. La Conner, Skagit County. (Gardner).

147. *Oscillatoria minnesotensis* Tilden. American Algae. Cent. VI. no. 596. 1902.

Plate IV. fig. 21.

Plant mass thin, dark blue-green; trichomes 2-5 mic. in diameter, more or less curved, especially constricted at joints; apex of trichome straight or slightly bent, neither tapering nor capitate; apical cell rotund; calyptra none; cells 2-4 mic. in length; transverse walls pellucid; cell contents homogeneous.

Minnesota. On sides of stone quarry under dripping water. Near Campus, University of Minnesota, Minneapolis, February 1902. (Lilley).

The plant differs from *O. geminata* in the length of the cells, in the absence of granules, and in its habitat. Like that species, also it resembles a *Phormidium*, but the trichomes when examined were oscillating rapidly thus showing conclusively that it was an *Oscillatoria*.

148. *Oscillatoria chlorina* Kuetzing. Phyc. Gen. 185. 1853. Gomont. Monogr. Oscill. 243. 1893. De Toni. Syll. Algar. 5: 172. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 18. pl. 1. f. 1. 1872. **Wolle.** Fresh-Water Algae U. S. 311. pl. 206. f. 6. 1887. **Collins.** Algae of Middlesex County, Massachusetts. 15. 1888. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 19. no. 901. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 183. 1903. **Clark.** The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala. Proc. Biol. Soc. Wash. 21: 97. 1908.

Plate IV. fig. 22.

Plant mass very thin, cobwebby, yellowish green; trichomes 3.5-4 mic. in diameter, straight or curved, fragile, not constricted at joints; apex of trichome straight or curved, not tapering; apical cell rotund; calyptra none; cells 3.7-8 mic. in length; transverse walls pellucid, not granulated; cell contents nearly homogeneous, orange or yellowish green.

Greenland. (Richter). **Massachusetts.** Newton. (Farlow). **Pennsylvania.** In stagnant brick pond. Near Philadelphia. (Wood). **Nebraska.** In culture in greenhouse. Lincoln. (Bessey). **Washington.** Growing on decaying vegetation in a small pool, submerged about two feet. Whidbey

Island. June 1901. **Central America.** Forming a dirty green, somewhat firm mass, looking much like a fresh-water sponge. Lake Atitlan and Amatitlan, Guatemala. 1905-1906. (Meek).

149. *Oscillatoria angustissima* W. and G. S. West. Welwitsch's African Freshwater Algae. Journ. of Bot. 300. 1897. De Toni. Syll. Algar. 5: 171. 1907.

West. West Indian Freshwater Algae. Journ. of Bot. 42: 293. 1904. Buchanan. Notes on the Algae of Iowa; Proc. Iowa Acad. Sci. 14: 14. 1908.

Plant mass expanded, blue-green; trichomes .6 mic. in diameter, not constricted at joints, flexible, elongate, entangled; apex of trichome neither tapering nor capitate; cells .9-1.2 mic. long; transverse walls not distinct; cell contents homogeneous, light blue-green.

Iowa. In pond with other algae. Ontario. (Buchanan). West Indies. Bay Estate, Barbados. (Howard).

150. *Oscillatoria splendida* Greville. Flora Edinensis. 305. 1824. Gomont. Monogr. Oscill. 244. pl. 7. f. 7, 8. 1893. De Toni. Syll. Algar. 5: 173. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*O. gracillima* Kg.); Fresh Water Algae. III. l. c. 6: 183. 1877; (*O. leptotrichia* Kg.); Fresh-Water Algae. U. S. 311. pl. 206. f. 7. 1887. Bennett. Plants of Rhode Island. 115. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 20. 1894. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 305. 1897. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 184. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1161. 1904. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate IV. fig. 23-25.

Trichomes 2-3 mic. in diameter, scattered or collected in a thin mass, straight or somewhat flexuous, elongate, not constricted at the joints; apex of trichome gradually tapering, flexuous, capitate; apical cell inflated above; calyptra none; cells 3-9 mic. in length; transverse walls marked by a few protoplasmic granules; cell contents homogeneous, blue-green.

Rhode Island. Providence. (Bennett). Connecticut. On submerged leaves in quiet water. September 1895; in a still pool with decaying vegetable matter, bed of Pequonnock River, August, September, November. (Holden). New Jersey. On small freshwater ponds; in ditches of brackish water. (Wolle). Nebraska. On basin of artesian well (salt). Lincoln. (Saunders). Washington. On mud in fresh water pools. Seattle. (Gardner). California. In a small stream near Berkeley. September 1901. (Gardner). Hawaii. On sides of wet rocks. Laupahoehoe, Island of Hawaii. July 1900. (Tilden).

Var. *uncinata* Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 184. pl. 19. f. 22-24. 1903. De Toni. Syll. Algar. 175. 1907.

Trichomes flexuous, coiled; apical cell very long, hooked.

Washington. On damp mud at the bottom of a pool nearly dried up. Oak Harbor, Whidbey Island. (Gardner).

151. *Oscillatoria amoena* (Kuetzing) Gomont. Monogr. Oscill. 245. pl. 7. f. 9. 1893. De Toni. Syll. Algar. 5: 175. 1907.

Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896. Saunders. The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. 1901.

Plate IV. fig. 26.

Trichomes 2.5-5 mic. in diameter, scattered or forming a mass, elongate, straight, flexible, slightly constricted at the joints; apex of trichome gradually tapering, capitate, hooked or undulate; apical cell furnished with a depressed conical calyptra; cells 2.5-4.2 mic. long (apical cell longer); transverse walls marked by two finely granulated lines; cell contents dull blue-green.

Alaska. Forming a soft, felt-like, dark bluish green mass, 3-10 mm. thick, of indefinite extent, lining the bottom of the outlet of a hot spring. The water in the outlet where the plant was abundant ranged from 80° F., some distance from the spring, to 120° F., near the spring. Near Sitka. (Saunders). Massachusetts. On rocks and trunks of trees. (Collins).

152. *Oscillatoria subuliformis* Kuetzing. Diag. und Bemerk. Algenspecies. Oster-progress. 7. 1863. Gomont. Monogr. Oscill. 246. 1893. De Toni. Syll. Algar. 5: 176. 1907.

Farlow. Marine Algae of New England. 33. 1881. Collins. Algae of Middlesex County, Massachusetts. 15. 1888; Marine Algae of Nantucket. 4. 1888. Martindale. Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. Collins. Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 248. 1894.

Plate IV. fig. 27.

Plant mass dull green; trichomes 4.7-6.5 mic. in diameter, much elongated, flexuous, undulating, not constricted at the joints; apex of trichome tapering for some distance, especially flexuous; apical cell obtuse, not capitate; calyptra none; cells 4.7-6.5 mic. in length (apical cell up to 10 mic. long); cell contents finely granular, sometimes showing large refringent granules.

Maine. On rocks near Seal Harbor. (Collins). Massachusetts. Salt marshes. Charles River, Cambridge. (Farlow). Mystic River marshes; on wharves. (Collins). New Jersey. In brackish ditches and pools. Atlantic City. (Morse, Martindale). Staten Island. (Pike).

153. *Oscillatoria salinarum* Collins in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1160. 1904. De Toni. Syll. Algar. 5: 176. 1907.

Collins. New species, etc., issued in the *Phycotheca Boreali-Americana*. *Rhodora*. 8: 105. 1906.

Trichomes 4 mic. in diameter, somewhat flexuous, sometimes coiled in a regular circle, very much constricted at joints; apex of trichome tapering, slightly curved, obtuse; calyptra none; cells nearly or quite as long as broad.

West Indies. Ditches of salt works. Salinas Bay, near Guanica, Porto Rico. June 1903. (Howe).

154. *Oscillatoria laetevirens* Crouan. Liste des Algues marine découvertes dans le Finistère, etc. Bull. Soc. Bot. France. 7: 371. 1860. Gomont. Monogr. Oscill. 246. pl. 7. f. 11. 1893. De Toni. Syll. Algar. 5: 177. 1907.

Collins. Preliminary Lists of New England Plants. V. Marine Algae. *Rhodora*. 2: 42. 1900. Tilden. Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 113. 1901; American Algae. Cent. V. no. 496. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1054. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 184. 1903. West. West Indian Freshwater Algae. Journ. of Bot. 42: 292. 1904. Collins. Phycological Notes of the late Isaac Holden.—I. *Rhodora*. 7: 172. 1905. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. 1905.

Plate IV. fig. 28.

Plant mass thin, membranaceous, bright blue-green; trichomes 3-5 mic. in diameter, straight, fragile, slightly constricted at the joints; apex of trichome briefly tapering, undulating and hooked, rarely straight; apical cell more or less obtuse or somewhat pointed, not capitate; calyptra none; cells 2.5-5 mic. in length; transverse walls granulated or cell contents uniformly granular, yellowish green.

Maine. On woodwork under old tide mill. Harpswell. July 1903. (Collins). **Rhode Island.** (Collins). **Connecticut.** Forming a film on old grassy bottom, brackish marsh pool. Cook's Point. June. (Holden). **Washington.** In salt marsh. Head of Penn's Cove, Whidbey Island. (Gardner). **West Indies.** On roots of mangroves in brackish swamp. Near Bridgetown; Graeme Hall Swamp, Barbados. (Howard). **Hawaii.** Forming a delicate, bright blue-green stratum covering bottom of tide pool in rocks into which water splashes at high tide. Waianae, Oahu. May 1900. (Tilden). Washings from marine algae. (Schauinsland).

155. *Oscillatoria acuminata* Gomont. Monogr. Oscill. 247. pl. 7. f. 12. 1893. De Toni. Syll. Algar. 5: 177. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 27. no. 1303. 1906.

Plate IV. fig. 29.

Plant mass blue-green; trichomes 3-5 mic. in diameter, straight, fragile, sometimes slightly constricted at joints; apex of trichome briefly tapering, very sharply pointed, hooked or twisted, not capitate; apical cell mucronate; calyptra none; cells 5.5-8 mic. in length; transverse walls granulated or entire cell contents filled with granules.

California. Floating in warm salt water from a power house. Oakland. October 1905, June 1906. (Gardner).

156. *Oscillatoria animalis* Agardh. Aufzählung, etc. Flora. 10: 632. 1827. Gomont. Monogr. Oscill. 247. 1893. De Toni. Syll. Algar. 5: 178. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 16. 1870-1877. (*O. thermalis* Crouan).

Plate IV. fig. 30.

Plant mass blue-green; trichomes 3-4 mic. in diameter, straight, fragile, not constricted at the joints; apex of trichome briefly tapering, sharply pointed, hooked or twisted, not capitate; apical cell mucronate; calyptra none; cells 1.6-5 mic. in length; transverse walls here and there granulated; protoplasmic contents finely granular.

North America. (Farlow). West Indies. Guadeloupe. (Mazé and Schramm).

157. *Oscillatoria violacea* (Wallroth) Hassall. British Freshwater Algae. 254. pl. 72. f. 10. 1845. De Toni. Syll. Algar. 5: 179. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877; Fresh-Water Algae U. S. 311. pl. 206. f. 10. 1887. Bennett. Plants of Rhode Island. 115. 1888. Bessey. Miscellaneous Additions to the Flora of the State, and new or noteworthy species from various localities. Bot. Surv. Nebraska. 46. 1893. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 21. 1894.

Plate IV. fig. 31.

Plant mass membranaceous, dull green or lead-colored; trichomes 4-4.5 mic. in diameter, straight, narrow, tangled; apical cell drawn out to a thin point; cells shorter than the diameter of trichome; transverse walls granulated; cell contents finely granular, violet or sky-blue in color.

Rhode Island. Common. (Bennett). Pennsylvania. Most frequent in greenhouses. (Wolle). Nebraska. In greenhouse at University. Lincoln. (Bessey, Saunders).

158. *Oscillatoria brevis* Kuetzing. Phyc. Gen. 186. 1843. Gomont. Monogr. Oscill. 249. pl. 7. f. 14, 15. 1893. De Toni. Syll. Algar. 5: 180. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877; Fresh-Water Algae. U. S. 312. pl. 207. f. 8. 1887. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. Tilden. American Algae. Cent. I. no. 77. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895; American Algae. Century VI. no. 597. 1902. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1158. 1904. West. West Indian Freshwater Algae. Journ. of Bot. 42: 292. 1904. (Also *O. subbrevis* Schmidle?).

Plate IV. fig. 32.

Plant mass olive green; trichomes 4-6.5 mic. in diameter, scattered or in masses, especially straight, fragile, not constricted at joints; here and

there interrupted by inflated, refringent cells; apex of trichome somewhat pointed, briefly tapering, hooked or twisted, not capitate; calyptra none; cells 1.5-2.8 mic. in diameter; transverse walls not granulated; cell contents finely granular.

New York. Forming an extended stratum on a shaded deposit of mud after an inundation. Buffalo. (Wolle). **New Jersey.** Fresh water, in marshes, frequent. (Wolle). **Minnesota.** Growing on clods of damp earth in greenhouse. St. Paul. November 1894; in pool coating bottom, submerged leaves and sticks, Lincoln Park, Duluth. (Tilden). **California.** Pool by roadside. North Berkeley. February 1903. (Gardner). **West Indies.** (Kunze). Near Bridgetown; Bay Estate, Barbados. (Howard).

Var. *neapolitana* (Kuetz.) Gomont. l. c. 249. De Toni. l. c. 181.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 27. no. 1304. 1906.

Trichomes 5-6.5 mic. in diameter; apex of trichome hooked or twisted.

California. In pool in salt marsh. Oakland, July 1905. (Gardner).

159. *Oscillatoria cruenta* Grunow in Rabenhorst. Fl. Eur. Algar. 2: 100. 1865. De Toni. Syll. Algar. 5: 182. 1907.

Wolle. Fresh-Water Algae U. S. 312. pl. 206. f. 5; pl. 207. f. 1-3. 1887.

Clark. The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala. Proc. Biol. Soc. Wash. 21: 96. 1908.

Plant mass mucous, dark purple; trichomes 4-7 mic. in diameter; apical cell obtuse, straight, rarely slightly curved; cells 2-4 mic. in length; transverse walls granulated; cell contents pale brown or blue-green.

Pennsylvania. Imbedded in large submerged hyaline or greenish or purplish, firm gelatinous masses of irregular form, averaging about the size of a man's head. In mountain spring at about 1500 feet elevation. (Wolle). **Central America.** Abundant, forming a flat, gelatinous, striated stratum, brownish in color, about 4 mm. thick, obtained from the surface between pools of hot water. Laguna. January 1906. (Meek).

160. *Oscillatoria formosa* Bory. Dict. Class. d'Hist. Nat. 12: 474. 1827. Gomont. Monogr. Oscill. 250. 1893. De Toni. Syll. Algar. 5: 182. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 16. 1870-1877. (*O. thermalis*). Tilden. American Algae. Cent. II. no. 192. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 710. 1900. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901. Tilden. Algae collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 166. 1902. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1053. 1903. Collins. Phycological Notes of the late Isaac Holden.—I. Rhodora. 7: 172. 1905.

Plate IV. fig. 33.

Plant mass dark blue-green; trichomes 4-6 mic. in diameter, straight, elongate, flexuous, usually slightly constricted at joints; apex of trichome somewhat obtuse and briefly tapering or rotund, hooked, not capitate; calyp-

tra none; cells 2.5-5 mic. long; transverse walls sometimes finely granulated; cell contents bright blue-green.

Canada. In tufts floating in water or on muddy bottom; in great abundance in the impure water just below mouth of city sewer. Kettle Creek, St. Thomas, Ontario. November 1896. (Lees). **Connecticut.** Floating in stagnant marsh pool near "Fresh Pond" (brackish). Stratford. May 1900. (Holden). **Minnesota.** University plant house, Minneapolis. January 1897. (Tilden). **Nebraska.** In culture in greenhouse. Lincoln. (Bessey). **California.** Mountain lake, San Francisco. June 1902. (Osterhout and Gardner). **West Indies.** Guadeloupe. (Mazé and Schramm). In still water. Roaring River, near St. Ann's Bay. March 1893; Castleton. April 1893. (Humphrey). **Hawaii.** On sides of cliff at falls. Waialuka River, Hilo, Island of Hawaii. July 1900. (Tilden).

161. *Oscillatoria numidica* Gomont. Monogr. Oscill. 251. 1893. De Toni. Syll. Algar. 5: 183. 1907.

Tilden. American Algae. Cent. I. no. 78. 1894; List of fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895; American Algae. Cent. VI. no. 598. 1902.

Plant mass dark blue-green; trichomes 2.5-4 mic. in diameter, straight, fragile, constricted at joints, gradually tapering for some distance from the apex; apex of trichome curved or undulating; apical cell obtuse, not capitate; calyptra none; cells 2-8 mic. long; transverse walls not granulated; cell contents uniformly granular; pale blue-green.

Minnesota. In tanks clinging to water plants. Greenhouse. Minneapolis. November 1894. (Tilden). On floating leaves and grasses in pool in stone quarry. Minneapolis. October 1901. (Hone).

162. *Oscillatoria cortiana* Meneghini. Conspectus Algol. eugan. 8. 1837. Gomont. Monogr. Oscill. 251. 1893. De Toni. Syll. Algar. 5: 183. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877; Fresh-Water Algae U. S. 313. pl. 206. f. 15. 1887.

Plate IV. fig. 34.

Plant mass dull or dark blue-green; trichomes 5.5-8 mic. in diameter, especially straight, fragile, slightly constricted at the joints, gradually tapering for some distance from the apex, curved or undulating at the extremity; apical cell obtuse, not capitate; calyptra none; cells 5.4-8.2 mic. in length (apical cell up to 14 mic. long); transverse walls not granulated; cell contents showing scattered protoplasmic granules, blue-green.

Pennsylvania. Floating on hot waste water at a large steam mill. Near Bethlehem. (Wolle).

163. *Oscillatoria okeni* Agardh. Aufzählung, etc. Flora. 10: 633. 1827. Gomont. Monogr. Oscill. 252. pl. 7. f. 18. 1893. De Toni. Syll. Algar. 5: 185. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 184. 1903.

Plate IV. fig. 35.

Plant mass dark blue-green; trichomes 5.5-9 mic. in diameter, straight (in dried material fragile), evidently constricted at joints, gradually tapering for some distance from apex; apex of trichome undulating, hooked or curved at extremity; apical cell obtuse or somewhat pointed, not capitate; calyptra none; cells 2.7-4.5 mic. in length; apical cell somewhat quadrate or up to 8 mic. in length; cell contents finely granular.

Washington. In pond of brackish water. Monroe's Landing, near Coupeville, Whidbey Island. (Gardner).

164. *Oscillatoria chalybea* Mertens in Jürgens. Algae aquat. Decas 13. no. 4. 1822. Gomont. Monogr. Oscill. 252. 1893. De Toni. Syll. Algar. 5: 185. 1907.

Wolle. Fresh-Water Algae U. S. 314. pl. 206. f. 17-21. 1887. Tilden. A new *Oscillatoria* from California. Bull. Torr. Bot. Club. 23: 58. 1896. (*O. trapezoidea* Tilden). Setchell. *Oscillatoria trapezoidea* Tilden. Erythea. 4: 69. 1896. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1001. 1903. (*O. chalybea genuina*). Collins. Phycological Notes of the late Isaac Holden.—I. Rhodora. 7: 172. 1905.

Plate IV. fig. 36.

Plant mass dark green; trichomes 8-13 mic. in diameter, fragile, straight, or sometimes twisted in loose spirals, slightly constricted at joints, gradually tapering for a long distance from the apex; apex hooked or curved; apical cell obtuse, not capitate; calyptra none; cells 3.6-8 mic. long; transverse walls not at all or scarcely granulated; cell contents finely granular with scattered large refringent granules, dark blue-green.

North America. (Pike, Martindale, Farlow). **Connecticut.** Outlet of Fresh Pond; on woodwork, rocks and *Enteromorpha*, below Yellow Mill Bridge. May, June, November. (Holden). **Florida.** On wet ground, (Wolle). **Ohio.** Plankton. Put-in-Bay, Lake Erie. (Snow). **Nebraska.** In stagnant water. Waverly. (Bessey). **California.** Bottom of pond. Pasadena. October 1895. (McClatchie). Lake Chabot, San Leandro. June 1902. (Osterhout and Gardner).

165. *Oscillatoria subsalsa* Agardh. Syst. Algar. 66. 1824. De Toni. Syll. Algar. 187. 1907.

Kjellman. Algae of the Arctic Sea. 323. 1883.

Plant mass dark blue-green, mucous, radiating; trichomes 8-10 mic. in diameter, straight, somewhat constricted at joints; apex of trichome equal or slightly tapering, obtuse, straight or curved; cells 4-5 mic. in length; cell contents granular, pale blue-green.

Greenland. "According to a label it grows 'in fossis submarinis.' Baffin Bay: Tessarmiut on the west coast of Greenland according to specimens in the herbarium of the Copenhagen Museum."—Kjellman.

166. *Oscillatoria percursa* Kuetzing. Phyc. Gen. 189. 1843. De Toni. Syll. Algar. 5: 187. 1907.

Mackenzie. A preliminary list of Algae collected in the neighborhood of Toronto. Proc. of Can. Inst. III. 7: 270. 1890.

Plant mass thin, green; trichomes 15.5-18.5 mic. in diameter, sometimes solitary, straight; apex of trichome usually curved, somewhat tapering, obtuse-truncate; cells 4-6 mic. in length; dissepiments evidently granulated; cell contents very finely granular, pale blue-green.

Canada. High Park, Toronto. (Mackenzie).

167. *Oscillatoria boryana* Bory. Dict. Class. d'Hist. Nat. 12: 465. 1827. Gomont. Monogr. Oscill. 254. 1893. De Toni. Syll. Algar. 5: 188. 1907.

Tilden. Notes on a collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 153. 1908.

Plate IV. fig. 37, 38.

Plant mass dark lead-colored; trichomes 6-8 mic. in diameter, forming a lax and regular spiral through their entire length, or straight and hooked at the apex, flexuous, constricted at joints; apex of trichome more or less pointed, not capitate; apical cell rotund or acute conical; calyptra none; cells 4-6 mic. in length; transverse walls here and there finely granulated; cell contents showing a few protoplasmic granules.

Central America. Forming a dark velvety mass in a small stream of warm water a little distance from a hot spring on bank of river. Altitude 3,950 feet. Rio Michatoya, near Lake Amatitlan. January 1906. (Kellerman).

168. *Oscillatoria terebriformis* Agardh. Aufzählung, etc. Flora. 10: 634. 1827. Gomont. Monogr. Oscill. 254. pl. 7. f. 24. 1893. De Toni. Syll. Algar. 5: 189. 1907.

Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896.

Plate IV. fig. 39.

Plant mass dark lead-colored; trichomes 4-6.5 mic. in diameter, flexuous, straight below, loosely spiralled and terebriform above, not constricted at joints; apex of trichome slightly tapering, rarely hooked; apical cell rotund or truncate; calyptra none; cells 2.5-6 mic. in length; transverse walls usually granulated.

Massachusetts. On rocks and trunks of trees. (Collins).

169. *Oscillatoria subtorulosa* (Brébisson) Farlow. Marine Algae of New England. 33. 1881. De Toni. Syll. Algar. 5: 191. 1907.

Hay and Mackay. List of the Marine Algae of the Maritime Provinces of Canada, with Notes. Trans. Roy. Soc. Canada. 5: 1887. **Collins.** Marine Algae of Nantucket. 4. 1888.

Trichomes 3-4 mic. in diameter, slightly constricted at joints; cells nearly quadrate.

Canada. On floating balls of *Polysiphonia*. Pictou Harbor, Nova Scotia. (Mackay). **Maine.** Forming slimy patches on wharves. Eastport. (Farlow). **Massachusetts.** Wood's Holl. (Farlow).

Genus *TRICHODESMIUM* Ehrenberg.

Ann. Physik. u. Chemie. 18: 506. 1830.

Plants forming scale-like, disconnected, free-floating colonies quickly dissolving into mucous; trichomes cylindrical, without sheaths; apex of trichome straight, tapering, slightly capitate; apical cell truncate-conical, furnished with a convex calyptra.

Floating in great abundance in the ocean, especially in equatorial regions.

I Trichomes straight.

T. erythraeum

II Trichomes flexuous or spirally twisted.

1 Colonies up to 6 mm. in length; trichomes 7-16 mic. in diameter, not constricted at joints, those in center of colony having the form of twisted ropes, free at the ends *T. thiebautii*

2 Colonies spirally twisted, light yellow; trichomes 16-25 mic. in diameter, twisted together into cords. *T. contortum*

170. *Trichodesmium erythraeum* Ehrenberg. Neue Beobachtungen über blutartige Erscheinungen in Aegyptien, Arabien und Sibirien. In Poggendorf. Ann. Physik. u. Chem. 18: 506. 1830. Gomont. Monogr. Oscill. 216. pl. 5. f. 27-30. 1893. De Toni. Syll. Algar. 5: 202. 1907.

Montagne. Mémoire sur le phénomène de la coloration des eaux de la Mer Rouge. Ann. Sci. Nat. Bot. III. 2: 360. pl. 10. f. d. 1844. (T. hindsii).

Plate IV. fig. 40.

Colonies very short, scarcely 1 mm in length, purplish red (when dried grayish green or dark brown); trichomes 7-11, rarely up to 21 mic. in diameter, straight, parallel, constricted at joints, the more slender ones with apices gradually tapering, the larger ones with apices very briefly tapering; cells 5.4-11 mic. in length; cell contents coarsely granular.

Central America. In dense masses of a beautiful red color, on surface of ocean. The odor was pronounced and very disagreeable. San Salvador. 14° lat. N. April 1837. (Hinds).

It is interesting to note that it is the presence of this alga which has caused the Red Sea to be so named.

171. *Trichodesmium thiebautii* Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 356. 1890; Monogr. Oscill. 217. pl. 6. f. 2-4. 1893. De Toni. Syll. Algar. 5: 203. 1907.

West Jun., W. Some Oscillarioideae from the Plankton. Journ. of Bot. 37: 337. 1899. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. 1905.

Plate IV. fig. 41, 42.

Colonies up to 6 mm. in length (in dried material dark green); trich-

omes 7-16 mic. in diameter, not constricted at joints, those in center of colony having the form of twisted ropes, free at the ends; apex of trichome briefly tapering or sometimes inflated; cells 8-26 mic. in length, rarely somewhat quadrate; transverse walls often granulated; cell contents coarsely granular.

West Indies. Guadeloupe. (Thiebaut). In plankton. (Murray and Blackman. Hawaii. In plankton between the islands of Hawaii and Laysan. 1896-1897. (Schauinsland).

172. *Trichodesmium contortum* Wille in Brandt. Nordisches Plankton.

Lief. 2. Abt. 20. 18. f. 14. De Toni. Syll. Algar. 5: 204. 1907.

Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 618. 1905.

Plate IV. fig. 43.

Colonies spirally twisted, light yellow; trichomes 16-25 mic. in diameter, twisted together into cords; cells somewhat quadrate; cell contents uniformly granular.

Hawaii. In plankton between the Islands of Hawaii and Laysan. 1896-1897. (Schauinsland).

Genus *ARTHROSPIRA* Stizenberger. Hedwigia. 1: 32. 1852.

Trichomes multicellular, cylindrical, without a sheath, forming a very regular, more or less loose spiral; apex of trichome sometimes tapering; apical cell rotund; calyptra none.

I Trichomes 5-8 mic. in diameter, forming a loose spiral 9-15 mic. in diameter, the distance between the turns being 21-31 mic.

A. jenneri

II Trichomes 2.5-3 mic. in diameter, forming a rather loose spiral about 6 mic. in diameter, the distance between the turns being 16-18 mic.

A. gomontiana

173. *Arthrospira jenneri* (Kuetzing) Stizenberger. Spirulina and Arthrospira. Hedwigia. 1: 32. 1852. Gomont. Monogr. Oscill. 267. pl. 7. f. 26. 1893. De Toni. Syll. Algar. 5: 206. 1907.

Wolle. Fresh-Water Algae U. S. 323. pl. 210. f. 2. 1887. (*Spirulina jenneri* Kuetz.) Bennett. Plants of Rhode Island. 115. 1888. Tilden. List of fresh-water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 23. pl. 1. f. 7. 1894. Riddle. Algae from Sandusky Bay. Ohio Nat. 3: 317. 1902. Brown. Algal periodicity in certain ponds and streams. Bull. Torr. Bot. Club. 35: 248. 1908.

Plate IV. fig. 44.

Plant mass thin; trichomes 5-8 mic. in diameter, often growing among other algae, fragile, forming a loose spiral 9-15 mic. in diameter, sometimes slightly constricted at joints; apex of trichome not tapering, nor capitate; cells quadrate or shorter than the diameter, 4-5 mic. long; transverse walls sometimes finely granulated; cell contents scarcely granular, dark blue-green.

Rhode Island. Quidnessett. (Bennett). New York. In some abundance near Schenectady. (Holden). Pennsylvania. In stagnant water. (Wolle). Ohio. Sandusky Bay. (Riddle). Indiana. Edge of Monon Pond, Bloomington. (Brown). Minnesota. Home Brook, Gull Lake Biological Station, Cass County. July 1893. (Tilden). In lake two miles west of Inver Grove, St. Paul. April 1908. (Misz). Nebraska. Found occasionally in stagnant water about Lincoln. (Saunders).

174. *Arthrospira gomontiana* Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 430. 1895. De Toni. Syll. Algar. 5: 208. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 155. 1896. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 235. 1905.

Plant mass floating, verdigris-green; trichomes 2.5-3 mic. in diameter, regularly twisted into a rather loose spiral about 6 mic. in diameter, the distance between the turns being 16-18 mic.; apical cell not at all capitate; cells 4-5 mic. in length; transverse walls indistinct, with few granules; cell contents usually showing large vacuoles, light blue-green.

Connecticut. Floating in verdigris-green patches, on the pool below Factory Pond, Bridgeport. July 1895. (Setchell and Holden).

Genus *SPIRULINA* Turpin.

Dict. d'hist. nat. de Levrault. 50: 309. 1827.

Trichomes unicellular, cylindrical, without a sheath, forming a regular, more or less loose or close spiral; apex of trichome not tapering; cell contents homogeneous or slightly granular.

I Turns of the spiral not close together.

- 1 Trichomes 1.2-1.8 mic. in diameter, forming a more or less loose, somewhat irregular spiral 3.2-5 mic. in diameter, the distance between the turns being 3-5 mic. *S. meneghiniana*
- 2 Trichomes 1.2-1.7 mic. in diameter, forming a somewhat loose, regular spiral 2.5-4 mic. in diameter, the distance between the turns being 2.7-5 mic. *S. major*
- 3 Trichomes 2 mic. in diameter, forming an especially regular spiral 5 mic. in diameter, the distance between the turns being 5 mic. *S. nordstedtii*
- 4 Trichomes .6-.9 mic. in diameter, forming an especially regular spiral 1.5-2.5 mic. in diameter, the distance between the turns being 1.2-2 mic. *S. subtilissima*
- 5 Trichomes .4 mic. in diameter, forming an especially regular spiral 1.4-1.6 mic. in diameter, the distance between the turns being 1 mic. *S. tenerima*
- 6 Trichomes .9 mic. in diameter, forming a very loose spiral 1.5 mic. in diameter, the distance between the turns being 3.2 mic. *S. caldaria*

II Turns of the spiral close together.

- 1 Trichomes 1.2-1.8 mic. in diameter, forming a dense regular spiral 3-4.5 mic. in diameter, the turns being contiguous

S. versicolor

- 2 Trichomes 1-2 mic. in diameter, forming a somewhat irregular dense or rarely regular spiral 3-5 mic. in diameter, the turns being contiguous or nearly so

S. subsalsa

III Trichomes forming slender, flat, continuous bands (when untwisted forming a complete ring), normally flattened and twisted, with one to four or more turns.

S. duplex

175. *Spirulina meneghiniana* Zanardini. Notozie intorno alle Cellulari marine delle Lagune e de littorale di Venezia. Atti del I. R. Istituto veneto. 6: 80. 1847. Gomont. Monogr. Oscill. 270. pl. 7. f. 28. 1893. De Toni. Syll. Algar. 5: 209. 1907.

Collins. Notes on New England Marine Algae.—VI. Bull. Torr. Bot. Club. 23. 1: 1896; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900; Notes on Algae.—IV. Rhodora. 3: 289. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 18. no. 852. 1901.

Plate IV. fig. 45.

Plant mass compact, blue-green; trichomes 1.2-1.8 mic. in diameter, flexuous, curved, twisted into a more or less loose, somewhat irregular spiral, 3.2-5 mic. in diameter, the distance between the turns being 3-5 mic.; cell contents pale blue-green.

Massachusetts. In scattered filaments among other algae in a ditch of brackish water, salt marshes. Revere. August 1893; in considerable quantity in rock tide pools above high water mark, but reached by spray in stormy weather, on the Marblehead shore, near Clifton Station. July 1901. (Collins).

176. *Spirulina major* Kuetzing. Phyc. Gen. 183. 1843. Gomont. Monogr. Oscill. 271. pl. 7. f. 29. 1893. De Toni. Syll. Algar. 5: 210. 1907.

Tilden. American Algae. Cent. I. no. 79. 1894. (*S. subsalsa* Oersted); List of fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895; American Algae. Cent. II. no. 193. 1896; Observations on some West American Thermal Algae. Bot. Gaz. 25: 103. 1898. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 11. no. 501. 1898. Setchell. Notes on Cyanophyceae.—III. Erythea. 7: 54. 1899. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 14. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1102. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 182. 1903. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 15. 1908.

Plate IV. fig. 46.

Plant mass dark blue-green; trichomes 1.2-1.7 mic. in diameter, usually scattered among other algae, more or less flexuous, twisted into a somewhat loose, regular spiral 2.5-4 mic. in diameter, the distance between the turns being 2.5 mic.

Canada. Forming a very slippery but firm brownish black stratum and also scattered among other algae. Warm sulphur spring, Banff, Alberta. June 1901. (Butler and Polley). **Minnesota.** Twin Lakes, Hennepin County. October 1894. (Tilden). **Iowa.** Slough. Ontario. (Buchanan). **South Dakota.** In artesian water. Iroquois. September 1897. (Saunders). **Nebraska.** In salt creek, Lincoln. (Bessey). **Wyoming.** On surface of still pool into which overflow runs. Temperature 41° C. Mammoth Hot Springs. July 1896. (Tilden). Overflow of channel of geyser. Temperature 49° - 54.5° C. Spasmodic Geyser. Upper Geyser Basin. Yellowstone National Park. 1897. (Weed). **Utah.** Forming a whitish brittle scum in hot water. Bick's Hot Spring, Salt Lake City, July 1897. (Tilden). **Washington.** In pools of slightly brackish water. Monroe's Landing, near Coupeville, Whidbey Island. (Gardner). **California.** (Parish and McClatchie). **Hawaii.** Mixed with other algae, on sides of wet rocks. Laupahoehoe, Hawaii. July 1900. (Tilden).

This species is quite common in both the calcareous and silicious waters of Yellowstone Park. It is generally found with other algae.

177. *Spirulina nordstedtii* Gomont. Monogr. Oscill. 272. 1893. De Toni. Syll. Algar. 5: 212. 1907.

Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900.

Plant mass olive green; trichomes 2 mic. in diameter, fragile, twisted into an especially regular spiral 5 mic. in diameter, the distance between the turns being 5 mic.; cell contents pale blue-green.

Maine. (Collins).

178. *Spirulina subtilissima* Kuetzing. Phyc. Gen. 183. 1843. Gomont. Monogr. Oscill. 272. pl. 7. f. 30. 1893. De Toni. Syll. Algar. 5: 212. 1907.

Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 14. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 23. no. 1103. 1903. **Lemmermann.** Algenfl. Sandwisch-Inseln. Bot. Jahrb. 34: 619. 1905.

Plate IV. fig. 47.

Plant mass mucous, dark green; trichomes .6-9 mic. in diameter, agglutinated, flexuous, twisted into an especially regular spiral 1.5-2.5 mic. in diameter, the distance between the turns being 1.2-2 mic.; cell contents very pale green or yellowish.

Nebraska. In salt creek. Lincoln. (Bessey). **California.** In outflow from a sulphur spring. Mt. Diablo. Contra Costa County. July 1900. (Osterhout). **Hawaii.** Washings from marine algae. Laysan Island. 1896-1897. (Schauinsland).

179. *Spirulina tenerrima* Kuetzing. Phyc. Gen. 183. 1843. Gomont. Monogr. Oscill. 272. 1893. De Toni. Syll. Algar. 5: 213. 1907.

Trichomes mixed with other algae, .4 mic. in diameter, twisted into an especially regular spiral 1.4-1.6 mic. in diameter, the distance between the turns being 1 mic.; cell contents very pale blue-green.

United States. On damp earth. (Farlow).

180. *Spirulina caldaria* Tilden. Observations on some West American Thermal Algae. Bot. Gaz. 25: 103. pl. 8. f. 20. 1908. De Toni. Syll. Algar. 5: 216. 1907.

Plate IV. fig. 48.

Plant mass widely expanded, dark blue-green; trichomes .9 mic. in diameter, short, somewhat straight and stiff, forming a very loose spiral 1.5 mic. in diameter, the distance between the turns being 3.2 mic.

Canada. Forming a thick richly colored stratum on the surface of hot water very near the outlet of the springs. Natural Sulphur Springs. Banff. August 1897. (Tilden).

181. *Spirulina versicolor* Cohn in Rabenhorst. Fl. Eur. Algar. 2: 292. 1865. Gomont. Monogr. Oscill. 273. 1893. De Toni. Syll. Algar. 5: 213. 1907.

Collins. Notes on New England Marine Algae.—VII. Bull. Torr. Bot. Club. 23: 458. 1896; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900.

Plant mass delicate, mucous, dark purple; trichomes 1.2-1.8 mic. in diameter, flexuous, twisted into a dense regular spiral 3-4.5 mic. in diameter, the turns being close together; cell contents violet-purple.

Maine. Among other algae on a mooring buoy that had been hauled up on the beach. Cape Rosier. July 1896. (Collins).

Lyngbya gracilis and *Spirulina versicolor* "are, as far as I know, the only marine Nostochineae of a red color found in America; and it is somewhat interesting that both should have been found at the same time and place. The object on which they grew gives somewhat unusual conditions for the growth of algae; practically uniform depth combined with considerable movement of the water. It would hardly be safe to draw the conclusion that these conditions tended to produce the exceptional color, but it is of interest to note that the localities given by Gomont for both species are in the Mediterranean, Adriatic and Baltic, in all of which the tidal movement is quite small."—Collins.

182. *Spirulina subsalsa* Oersted. Beretning om en Excursion til Trindelen, alluvial Dannelsen i Odensfjord. Nat. Tidskr. 17. pl. 7. f. 4. 1842. Gomont. Monogr. Oscill. 273. pl. 7. f. 32. 1893. De Toni. Syll. Algar. 5: 214. 1907.

Farlow, Anderson and Eaton. Algae Americae borealis exsiccatae. Fasc. I-IV. no. 478. 1877. (*S. tenuissima* Kg.) Farlow. Marine Algae of New England. 31. pl. 2. f. 4. 1881. Kjellman. The Algae of the Arctic Sea. 324. 1883. Wolle. Fresh-water Algae. U. S. 323. pl. 210. f. 3. 1887. Collins. Algae of Middlesex County, Massachusetts. 15. 1888; Marine Algae of Nantucket. 4. 1888. Martindale. Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 610. 1889. Collins. Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 248. 1894. Saunders. Protophyta-Phyco-

phyta. Flora of Nebraska. 23. pl. 1. f. 6. 1894. **Rosenvinge**. Les Algues Marines du Groenland. Ann. Sci. Nat. Bot. VII. 19: 163. 1894. **Collins**, **Holden and Setchell**. Phyc. Bor.-Am. Fasc. 6. no. 252. 1897. **Rosenvinge**. Deuxième Mémoire sur les Algues Marines du Groenland. Medd. om Groenland. 20: 121. 1898. **Collins**. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900. **Setchell and Gardner**. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 182. 1903. **West**. West Indian Freshwater Algae. Journ. of Bot. 42: 293. 1904. **Collins**. Phycological Notes of the late Isaac Holden.—I. Rhodora. 7: 172. 1905. **Börgesen and Jonsson**. The distribution of the Marine Algae of the Arctic Sea and of the northernmost part of the Atlantic. Botany of the Faeroes. Appendix. XXV. 1905. **Clark**. The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala. Proc. Biol. Soc. Wash. 21: 96. 1908.

Plate IV. fig. 49.

Plant mass dark blue-green or greenish-yellow; trichomes often mixed with other algae, 1-2 mic. in diameter, twisted into a somewhat irregular dense (here and there loose), or rarely regular spiral, 3-5 mic. in diameter, the turns being contiguous to each other or almost so.

Greenland. Growing in cavities with brackish water among mouldering algae. Tessarmiut, Baffin Bay. (Wormskiold). West Greenland, south of 61° lat. N. (Rosenvinge). West Greenland and Atlantic North America. (Börgesen and Jonsson). **Maine**. Mixed with other algae, forming dark purple-colored patches on the wharves at low-water mark. Eastport. (Farlow). On rocks on shore near Seal Harbor. (Collins). (West). **New Hampshire**. (Collins). **Massachusetts**. Gloucester, Cambridge, Wood's Hole. (Farlow). Everett and Medford; on wharves, Nantucket. (Collins). **Connecticut**. In large jelly-like masses on stalks of *Ruppia* in Fresh Pond (brackish), Stratford. July 1892. ("Could take it up in jelly-like masses half an inch thick, pure *Spirulina*"). (Holden). **New York**. Frequent in sulphur springs. Clifton. (Wolle). **New Jersey**. Mixed with *Oscillatoria*. Atlantic City. (Morse). Swimming River, Monmouth County. (Britton). Staten Island. (Pike). Mixed with other minute forms. Atlantic City. (Martindale). **Florida**. Glen Cove Spring. (Wolle). **Nebraska**. Frequent in salt water. Lincoln. (Saunders). **Central America**. Growing in very warm water. Guatemala. (Meek). **West Indies**. On the roots of mangroves. Near Bridgetown; Graeme Hall Swamp, Barbados. (Howard).

Forma oceanica (Crouan) Gomont. l. c. 274. De Toni. l. c. 215.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 20. no. 954. 1902.

Trichomes 1 mic. in diameter, somewhat straight in outline, twisted into a regular spiral.

Washington. Floating in slightly brackish water. Crockett's Lake. June 1901; in mud of pools of brackish water on salt marshes, Whidbey Island. (Gardner).

183. *Spirulina duplex* Wolle. Fresh-Water Algae U. S. 323. pl. 210. f. 4, 5. 1887. De Toni. Syll. Algar. 5: 216. 1907.

Plate IV. fig. 50, 51.

Trichomes 2 mic. in diameter, when twisted 75-200 mic. long, having form of slender, flat, strap-like, continuous bands (when untwisted forming a complete ring), normally flattened and twisted, with one to four or more turns.

Minnesota. Frequent in pool near Minneapolis. (Wolle).

Genus **PHORMIDIUM** Kuetzing. Phyc. Gen. 190. 1843.

Filaments simple, forming a woolly or felt-like layer or rarely floating, attached at the base with free ends torn and ragged; sheaths thin, transparent, mucous, agglutinated, partly or entirely diffuent; trichomes cylindrical, in some species constricted at joints, never distinctly spiral; apex of trichome often tapering, straight or curved, capitate or not capitate; outer membrane of apical cell thickened into a calyptra in many species.

I Trichomes especially constricted at joints, even moniliform; apex of trichome neither curved nor capitate.

1 Trichomes scarcely 4 mic. in diameter

(1) Plants living in hot or in brackish water; trichomes 1.2-2.3 mic. in diameter; cells somewhat quadrate *P. fragile* ✓

(2) Plants living in salt water; plant mass rose-colored; trichomes 1.7-2 mic. in diameter; cells longer than the diameter

P. persicinum

(3) Plants terrestrial, nestling in pits in rocks; trichomes 1.5 in diameter; cells somewhat quadrate

P. foveolarum ✓

2 Trichomes 6-8.5 mic. in diameter

P. tinctorium

II Trichomes rarely or scarcely constricted at joints; apex of trichome straight or curved, capitate in many species

1 Trichomes scarcely 3 mic. in diameter

(1) Plant mass purplish violet, reddish brown or scarlet

A Filaments somewhat straight; trichomes slightly constricted at joints; transverse walls not granulated *P. luridum*

B Filaments somewhat straight; trichomes fragile, frequently interrupted, not constricted at joints; transverse walls rarely visible

P. rubrum

C Filaments very much twisted; trichomes not constricted at joints; transverse walls marked by four protoplasmic granules

P. purpurascens

D Filaments curved, entangled or arranged parallel with each other, trichomes not constricted at joints; apex of trichome straight, neither tapering nor capitate

P. crosbyanum

(2) Plant mass blue-green or olive

A Plants living in hot water; plant mass expanded, lamellose, composed of many superposed papery layers; trichomes .6-8 mic.

- in diameter, not constricted at joints; apex of trichome straight, not tapering
P. treleasei
- B Plant mass thin, membranaceous; trichomes 1-1.5 mic. in diameter, not constricted at joints; apex of trichome straight, tapering; transverse walls granulated
P. laminosum
- C Plant mass thin, membranaceous; trichomes 1-2 mic. in diameter, slightly constricted at joints; apex of trichome finally becoming tapered and bent; transverse walls not granulated
P. tenue
- D Plant mass thick, leathery; trichomes 2-2.5 mic. in diameter, not constricted at joints; apex of trichome straight, obtuse
P. valderianum
- E Plant mass lamellose; trichomes 2-2.8 mic. in diameter, slightly constricted at joints; apex of trichome gradually tapering, bent or twisted
P. subuliforme
- 2 Trichomes more than 3 mic. in diameter
- (1) Apex of trichome straight, not capitate
- A Apical cell obtuse conical
- a Plant mass encrusted with calcium carbonate
P. incrustatum
- b Plant mass not encrusted with calcium carbonate
- (a) Filaments somewhat straight; trichomes 3-5 mic. in diameter; transverse walls covered by protoplasmic granules
P. inundatum
- (b) Filaments flexuous; trichomes 3-4.5 mic. in diameter; cells 3.4-8 mic. in length; transverse walls conspicuous
P. corium
- (c) Filaments strongly flexuous; trichomes 3-5 mic. in diameter; cells 2-4 mic. in length; transverse walls conspicuous
P. papyraceum
- (d) Plant mass membranaceous, mucous; trichomes 5-6.5 mic. in diameter, interrupted; apex of trichome straight, obtuse; transverse walls sometimes finely granulated
P. interruptum
- (e) Plant mass thin; trichomes 16-18 mic. in diameter, frequently interrupted
P. naveanum
- B Apical cell not or scarcely tapering, truncate
- a Sheaths thin, fragile, soon diffuent; trichomes 4.5-12 mic. in diameter; cells 4-9 mic. in length
P. retzii
- b Sheaths firm, or mucous and diffuent, at times thick and lamellose; trichomes 4-6 mic. in diameter; cells 1.5-2.7 mic. in length.
P. ambiguum
- (2) Apex of trichome straight, capitate
- A Trichomes slightly constricted at joints
P. submembranaceum

B Trichomes not constricted at joints

- a Plants epiphytic, living in salt water; trichomes 4-4.5 mic. in diameter, irregularly curved, very rarely straight; apex of trichome gradually tapering; cells 4-11 mic. in length

P. laysanense

- b Plants living in warm or fresh water; trichomes 4.5-9 mic. in diameter, elongate, flexuous; apex of trichome gradually tapering; cells 3-7 mic. in length

P. favosum

- c Plants living in warm or fresh water; trichomes 6-8 mic. in diameter, apex of trichome scarcely tapering; apical cell oblique, depressed, conical

P. calidum

- d Plants living in fresh water; trichomes 5.5-11 mic. in diameter, straight, fragile; apex of trichome briefly tapering; apical cell straight, conical; cells 2-4 mic. in length

P. subfuscum

(3) Apex of trichome more or less curved, capitate

A Plant mass blue-green or dark brown

- a Plants living in fresh water; trichomes 6-9 mic. in diameter; apex of trichome curved or briefly spiraled

P. uncinatum

- b Plants living on damp soil or on rocks, rarely under water; trichomes 4-7 mic. in diameter; apex of trichome scarcely curved, sometimes straight

P. autumnale

B Plant mass dark purple

P. setchellianum

184. *Phormidium fragile* (Meneghini) Gomont. Monogr. Oscill. 183. pl. 4. f. 13-15. 1893. De Toni. Syll. Algar. 5: 220. 1907.

Collins. Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 248. 1894. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 10. no. 451. 1898. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. West and West. A further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 289. 1898-1900. Bessey, Poud and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901.

Plate IV. fig. 52, 53.

Plant mass mucous, lamellose, yellowish or dark blue-green; sheaths gelatinous, fibrous, diffuent into mucous; trichomes 1.2-2.3 mic. in diameter, more or less flexuous, entangled or somewhat parallel to each other, constricted at joints; apex of trichome tapering; apical cell acute-conical; calyptra none; cells 1.2-3 mic. long; cell contents not granular.

Maine. Forming a dull green, gelatinous stratum on woodwork. Near Seal Harbor; forming an encrustation in a tide pool, York Island, Penobscot Bay, July 1894. (Collins). Massachusetts. Northern part. (Collins). Nebraska. In aquaria. Lincoln. (Bessey). West Indies. In stream. Wotten Waven, Dominica. (Elliott).

185. *Phormidium persicinum* (Reinke) Gomont. Monogr. Oscill. 184. 1893. De Toni. Syll. Algar. 5: 220. 1907.

Collins. Notes on Algae.—II. Rhodora. 1: 11. 1900; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. West. West Indian Freshwater Algae. Journ. of Bot. 42: 292. 1904. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 29. no. 1401. 1907.

Plant mass a delicate, continuous, velvety, rose-colored coating on marine shells; filaments loosely entangled; sheaths close, diffuent into an amorphous mucus; trichomes 1.7-2 mic. in diameter, especially constricted at joints; apex of trichome tapering; apical cell acute conical; calyptra none; cells 2-7 mic. in length; cell contents homogeneous.

Massachusetts. Forming a thin pink film on shells, mostly on the *Spirorbis* which is often attached in great abundance to larger algae. Nahant. June 1899. (Collins). In a jar in the Marine Biological Laboratory. Wood's Hole. May 1907. (Davis). West Indies. On roots of mangroves in brackish swamp. Near Bridgetown, Barbados. (Howard).

186. *Phormidium foveolarum* (Montagne) Gomont. Monogr. Oscill. 164. pl. 4. f. 16. 1893. De Toni. Syll. Algar. 5: 221. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 184. 1903.

Plate IV. fig. 54.

Plant mass very thin, orbicular, "nestling" in depressions of cretaceous rocks, dark green; sheaths diffuent into an amorphous, gelatinous mucus; trichomes about 1.5 mic. in diameter, variously twisted, parallel, constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells .8-2 mic. in length; cell contents not granular, pale blue-green.

Washington. Mixed with *P. autumnale* in ditches by the roadside. Pleasant Ridge, near La Conner, Skagit County. (Gardner).

187. *Phormidium tinctorium* Kuetzing. Tab. Phyc. 1: 35. pl. 49. f. 3. 1845-1849. Gomont. Monogr. Oscill. 182. pl. 4. f. 11. 1893. De Toni. Syll. Algar. 5: 218. 1907.

Wolle. Fresh Water Algae. VI. Bull. Torr. Bot. Club. 9: 25. 1882; Fresh-Water Algae U. S. 301. pl. 202. f. 22, 23. 1887. (Lyngbya tinctoria Kg.)

Plate IV. fig. 55.

Plant mass penicillate, elongate, attached at base, waving, gelatinous, dark green, when dried yellowish purple, coloring paper violet; filaments somewhat straight, collected in fascicles, parallel; sheaths very mucous and diffuent; trichomes 6-8.5 mic. in diameter, much constricted at joints; apex of trichome straight, occasionally very gradually tapering; apical cell more or less acute conical or cylindrical conical; calyptra none; cells 5-11 mic. long; transverse walls not granulated; cells contents finely granular.

Arizona. In springs. April. (Pringle).

M. Gomont calls attention to the fact that the trichomes of this

species resemble very much those of *Microcoleus subtorulosus*, but the exterior aspect of the two plants is totally different.

188. *Phormidium luridum* (Kuetzing) Gomont. Monogr. Oscill. 185. pl. 4. f. 17, 18. 1893. De Toni. Syll. Algar. 5: 222. 1907.

West and West. A further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 289. 1898-1900. **West.** West Indian Fresh Water Algae. Journ. of Bot. 42: 292. 1904.

Plate IV. fig. 56, 57.

Plant mass membranaceous, lamellose, amethyst-purple or dark purple on the surface, gray or blue-green underneath; filaments somewhat straight; sheaths at first thin, scarcely visible, soon dissolving into a compact, gelatinous mucus; trichomes 1.7-2 mic. in diameter, fragile, straight, variously entangled, slightly constricted at joints; apex of trichome neither curved nor tapering; apical cell rotund; calyptra none; cells 1.8-4.7 mic. in length; cell contents not granular.

West Indies. Growing on sides of road, Fort Charlotte, St. Vincent. January and February 1896. (West). Roseau Valley, Dominica. (Howard).

189. *Phormidium rubrum* Tilden. American Algae. Cent. II. no. 186. 1896. Observations on some West American Thermal Algae. Bot. Gaz. 25: 100. pl. 9. f. 18. 1898. De Toni. Syll. Algar. 5: 223. 1907.

Plate IV. fig. 58.

Plant mass forming a thin layer, scarlet in color; filaments somewhat straight; sheaths visible only under high powers; trichomes 1 mic. in diameter, fragile, frequently interrupted, not constricted at joints; apex of trichome neither curved nor tapering; cells 1-1.2 mic. in length; transverse walls rarely visible.

Wyoming. In tepid water, in overflow from small hillside spring. Between Middle and Upper Geyser Basins, Yellowstone National Park. July 1896. (Tilden).

190. *Phormidium purpurascens* (Kuetzing) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 186. pl. 4. f. 19. 1893. De Toni. Syll. Algar. 5: 223. 1907.

Plate IV. fig. 59.

Plant mass compact, leathery, dark violet; filaments strongly twisted, closely entangled; sheaths narrow, papery, finally becoming diffuent and agglutinated; trichomes 1.5-2.5 mic. in diameter, not constricted at joints; apex of trichome neither tapering nor curved; apical cell rotund; calyptra none; cells 2-4.5 mic. in length; transverse walls marked by four protoplasmic granules.

Wyoming. Together with *Synechococcus aeruginosus* and *Gloeocapsa violacea*, forming black "stalactites," 1-1.5 dm. long and .5 dm. in thickness, also serrated masses or extended sheets. These hung from the top and lined the walls of a small cave in which was the vent of a hot spring. At short intervals they received jets of steam and

a spray of hot water. Valley of Nez Perces Creek, Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden).

Further study proved that the Yellowstone specimens should be placed under *Hyphoethrix calcicola* (Ag.) Rab. However, since there is some possibility that the material contains a mixture of the two species, the above description is allowed to stand.

191. *Phormidium crosbyanum* Tilden. American Algae. Cent. VII. Fasc. 1. no. 645. 1909.

Plate IV. fig. 60, 61.

Plant mass 2 cm. in thickness, 5 cm. in diameter, impregnated with lime, firm, somewhat hard, bluish green to brownish red in color; filaments curved, entangled or arranged parallel with each other; sheaths extremely delicate; trichomes 1-2 mic. in diameter, not constricted at joints; apex of trichome straight, neither tapering nor capitate; apical cell conical; calyptra none; cells 1.5-5 mic. long.

Hawaii. Forming reddish brown, flattened-globose cushions on upper side of rock shelf, between tides. Waianae, Oahu, May 1900. (Tilden).

It is usually very difficult to make out the sheaths protruding beyond the trichome, but empty sheaths are numerous.

192. *Phormidium treleasei* Gomont. Sur quelques Oscillariées nouvelles. Bull. Soc. Bot. de France. 46: 37. 1899. De Toni. Syll. Algar. 5: 234. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1006. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 186. 1903.

Plant mass expanded, lamellose, composed of many superposed papery layers; filaments parallel, very slender, straight, rigid; sheaths very thin, transparent, mucous, agglutinated; trichomes .6-.8 mic. in diameter, not constricted at joints; apex of trichome straight, not tapering; apical cell rotund; calyptra none; cells up to 8.8 mic. in length; cell contents pale blue-green.

Canada. Hot Sulphur Springs, Banff, Alberta. June 1901. (Butler and Polley). **Arkansas.** In hot springs. (Trelease).

193. *Phormidium laminosum* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 187. pl. 4. f. 21, 22. 1893. De Toni. Syll. Algar. 5: 225. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. (*O. elegans* Ag.) **Tilden.** American Algae. Cent. II. no. 181. 1896. Observations on some West American Thermal Algae. Bot. Gaz. 25: 98. f. 15. 1898. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 185. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 21. no. 1003. 1903. **West.** West Indian Freshwater Algae. Journ. of Bot. 42: 292. 1904. **Tilden.** Notes on a Collection of Algae from Guatemala.

Proc. Biol. Soc. Wash. 21: 154. 1908; American Algae. Cent. VII. Fasc. 1. no. 643. 1909.

Plate IV. fig. 62.

Plant mass thin, membranaceous, expanded, pale blue-green, golden yellow or brick-colored; filaments flexuous, densely entangled; sheaths narrow, papery, mucous or entirely diffuent into an amorphous mucus; trichomes 1-1.5 mic. in diameter, not constricted at joints; apex of trichome straight, briefly tapering, not capitate; apical cell acute conical; calyptra none; cells 2-4 mic. in length; transverse walls marked by four refringent granules, usually inconspicuous; cell contents blue-green.

Alaska. Forming a thin, membranaceous stratum on perpendicular rocks moistened by spray from a waterfall. Orca, Prince William Sound. (Saunders). **Pennsylvania.** Quiet waters. (Wolle). **Nebraska.** In running water in greenhouse. Lincoln. (Bessey). **Wyoming.** In overflow water of spring where the old formation makes a hard, billowy or terraced incline. The algae extend down the incline for a distance of twenty feet, forming wide ribbons of green, alternating with bands of pink, yellow, white and a darker green. Temperature of spring 91° C. Algal growth occurs at a temperature of 51-55° C. Ribbon Spring, Norris Geyser Basin. June 1896; in small shallow spring, expanding at top into leaf-like masses, or tapering from bulbous head to a small tubular base, temperature 55° C., Valley of Nez Perces Creek, Lower Geyser Basin, June 1896; in grassy rivulet, temperature 30° C., Mountain hot springs, Lower Geyser Basin, June 1896; around edges of springs, forming brown and green layers which turn gray or blackish, out of water, temperature 63° C., Prismatic Lake, Middle Geyser Basin, July 1896; forming plummy strings, white or light yellowish in color, temperature 75.5° C., Solitary Spring, Upper Geyser Basin, July 1896; forming a whitish, scurfy, hardened, rather brittle scum on surface of still pool into which overflow runs, temperature 41° C., Mammoth Hot Springs, July 1896, Yellowstone National Park. (Tilden). **Washington.** In a water trough fed by a spring. San Juan Island. July 1901. (Gardner). **Central America.** In a pool of very warm water close to a hot spring. Near Lake Amatitlan. January 1906. (Kellerman). **West Indies.** Royal Botanical Gardens, St. Ann's, Trinidad. (Howard).

This species was found to be "by far the most widespread and abundant of any alga in the hot waters of the Park. Its habit of growth is extremely varied, so that it is not easily recognized. It is the only species, except *Spirulina major*, that, so far as I know, is found in both calcareous and silicious waters in this region."—Tilden.

Forma weedii Tilden. Observations on some West American Thermal Algae. Bot. Gaz. 25: 99. pl. 9. f. 16. 1898. De Toni. Syll. Algar. 5: 226. 1907.

Plant mass blue-green; filaments often strongly bent; sheaths not visible, trichomes 2.5-3 mic. in diameter; apex of trichome sharply bent; cells 1.5-2.5 mic. long; transverse walls generally distinct, sometimes marked by granules; cell contents usually granular.

Wyoming. In overflow of channel. Temperature 49-54.3° C. With *Spirulina major*. Spasmodic Geyser, Upper Geyser Basin, Yellowstone National Park. 1897. (Weed).

This plant is very near typical *P. laminosum*. The points of difference are that the filaments are slightly greater in diameter, the apex is almost invariably sharply bent, and the transverse walls may or may not be marked by granules. Sometimes the entire cell contents are granular.

194. *Phormidium tenue* (Meneghini) Gomont. Monogr. Oscill. 189. pl. 4. f. 23-25. 1893. De Toni. Syll. Algar. 5: 227. 1907.

Wolle. Fresh-Water Algae. VI. Bull. Torr. Bot. Club. 9: 25. 1882. (*Oscillatoria deterosa* Stitz.); Fresh-Water Algae. U. S. 310. 1887. Bennett. Plants of Rhode Island. 115. 1888. Tilden. American Algae. Cent. II. no. 182. 1896; Observations on some West American Thermal Algae. Bot. Gaz. 25: 100. pl. 9. f. 17. 1898. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 13. no. 606. 1899. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 185. 1903. West. West Indian Freshwater Algae. Journ. of Bot. 42: 292. 1904. Brown. Algal Periodicity in certain Ponds and Streams. Bull. Torr. Bot. Club. 35: 248. 1908. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 13. 1908.

Plate IV. fig. 63-65.

Plant mass thin, membranaceous, expanded, pale blue-green; filaments elongate, somewhat straight, densely entangled; sheaths thin, finally diffluent into a fibrous mucus; trichomes 1-2 mic. in diameter, straight, slightly constricted at joints; apex of trichome not capitate, at first straight, afterwards becoming tapering and bent; apical cell acute-conical; calyptra none; cells 2.5-5 mic. in length; transverse walls usually indistinct; cell contents homogeneous, pale blue-green.

Alaska. In various situations, submerged and emergent, in fresh water. Walls of Amaknak Cave, Amaknak Island; Bay of Unalaska. (Setchell and Lawson). **Massachusetts.** In fresh water. Naushon Island. August 1895. (Nott). **Rhode Island.** Roger Williams Park. (Bennett). **New York.** Stagnant waters. Rochester. (Wolle). **Virginia.** In a pool in Luray Cave, 260 feet below the surface. (Seipt). **Indiana.** Edge of pond. Near Bloomington. May, June 1907. (Brown). **Iowa.** Frequent. Fayette. (Fink). On pots in greenhouse; in pond. Ames; in pond among decaying rushes, bottom of the margin of the slough. Eagle Grove. (Buchanan). **Nebraska.** On boards of mill-dam. Milford. (Bessey). **Wyoming.** Around edges of spring, not covered by water, but water flows in little streams through and around it. Mixed with *P. laminosum*. Temperature of water 33° C. Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden). **Washington.** Coupeville, Oak Harbor, Whidbey Island; Seattle. (Gardner). **West Indies.** Near Bridgetown; Bay Estate; Graeme Hall Swamp. Barbados. (Howard).

195. *Phormidium valderianum* (Delponte) Gomont. Monogr. Oscill. 187. pl. 4. f. 20. 1893. De Toni. Syll. Algar. 5: 223. 1907.

Hariot. Algues du Golfe de Californie recueillies par M. Diguët. Journ. de Bot. 9: 169. 1895. Setchell. Notes on some Cyanophyceae of New

England. 22: 430. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 103. 1895. Tilden. List of fresh-water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 28. 1898. Collins. Preliminary Lists of New England Plants. V. Marine Algae. Rhodora. 2: 42. 1900. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1105. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 184. 1903. Tilden. Notes on a Collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 154. 1908. Tilden. American Algae. Cent. VII. Fasc. 1. no. 644. 1909.

Plate IV. fig. 66.

Plant mass up to 3 cm. in thickness, slimy, expanded, lamellose, the upper layers dull green, the lower layers whitish; filaments flexuose, densely entangled; sheaths narrow, papery, finally diffuent into a tenaceous mucus and becoming agglutinated; trichomes 2-2.5 mic. in diameter, straight, not constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells 3.3-6.7 mic. in length; transverse walls marked by two or four protoplasmic granules; cell contents blue-green.

Alaska. On dripping timber of old mill. Sitka. (Setchell and Lawson). **Canada.** Forming a thick, stratified mass. Warm sulphur spring. Banff, Alberta. June 1901. (Butler and Polley). **Rhode Island.** "Forming verdigris-green gelatinous sheaths, later becoming chartaceous, on stones and on leaves of *Ruppia maritima* in brackish water. Watch Hill Pond, Watch Hill. September 1892." (Setchell). **Connecticut.** (Collins). **Minnesota.** In arm of Mississippi River (old channel). St. Paul Park. October 1897. (Freeman). **Gulf of California.** In thermal water at 75°. "Du ruisseau de l'Azufres au pied du volcan de las Virgenes." **Central America.** Associated with *Nodularia harveyana*. Laguna, Lake Amatitlan, Guatemala. Altitude 3950 feet. February 1905. (Kellerman).

196. *Phormidium subuliforme* Gomont. Monogr. Oscill. 189. pl. 4. f. 26. 1893. De Toni. Syll. Algar. 5: 230. 1907.

Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901.

Plate IV. fig. 67.

Plant mass lamellose, yellowish green; sheaths diffuent into an amorphous, gelatinous mucus; trichomes 2-2.8 mic. in diameter, straight, constricted at joints; apex of trichome gradually tapering, bent or twisted, not capitate; apical cell more or less acute-conical; calyptra none; cells 6-8 mic. in length; transverse walls distinct; cell contents homogeneous or coarsely granular, blue green.

Nebraska. In aquaria. Lincoln. (Bessey).

197. *Phormidium incrustatum* (Naegeli) Gomont in Bornet and Flahault. Sur quelques plantes vivant dans le test calcaire des Mollusques, in Bull. Soc. Bot. France. 36: 154. 1889; Monogr. Oscill. 190. pl. 4. f. 27. 1893. De Toni. Syll. Algar. 5: 230. 1907.

Tilden. American Algae. Century II. no. 183. 1896; List of fresh-water

Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1057. 1903.

Plate IV. fig. 68.

Plant mass encrusted with lime, crustaceous, very hard, dark red or violet; filaments curved, entangled or erect-parallel; sheaths thin, mucous, agglutinated; trichomes 4-5 mic. in diameter, not constricted at joints; apex of trichome straight, briefly tapering, not capitate; apical cell obtuse-conical; calyptra none; cells 3.5-5.2 mic. in length; transverse walls usually visible, sometimes granulated; cell contents showing scattered granules.

Wisconsin. In stream. Osceola. August 1895. (Tilden). **California.** On the sides of a water trough. Berkeley. September 1902. (Osterhout and Gardner).

Var. *catractarum* (Naeg.) Gomont. l. c. 190. De Toni. l. c. 231.

Wolle. Fresh-Water Algae. U. S. 302. pl. 202. f. 18, 19. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. **Brown.** Algal periodicity in certain ponds and streams. Bull. Torr. Bot. Club. 35: 248. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 13. 1908.

Filaments erect-parallel.

New Jersey. In rapid waters. (Wolle). **Pennsylvania.** Frequent at waterfalls, mill dams, etc., sometimes in cushion-like masses, two or three inches in thickness. (Wolle). **Indiana.** Jordan Branch, Bloomington. March to August 1907. (Brown). **Iowa.** Iowa City. (Hobby).

198. *Phormidium inundatum* Kuetzing. Spec. Algar. 251. 1849. Gomont. Monogr. Oscill. 192. pl. 4. f. 31, 32. 1893. De Toni. Syll. Algar. 5: 232. 1907.

Wolle. Fresh-Water Algae. VI. Bull. Torr. Bot. Club. 9: 25. 1882; Exsicc. no. 108. (*O. antliaria*); Fresh-Water Algae U. S. 303. pl. 202. f. 24, 25. 1887. (*L. inundata* Kg.) **Bennett** Plants of Rhode Island. 114. 1888. **Setchell.** Notes on Cyanophyceae.—III. Erythea. 7: 53. 1899. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 21. no. 1002. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 185. 1903. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 642. 1909.

Plate IV. fig. 69, 70.

Plant mass membranaceous, blue-green; filaments somewhat straight, fragile; sheaths thin, diffuent into an amorphous mucus; trichomes 3-5 mic. in diameter, straight or curved, not constricted at joints; apex of trichome straight, briefly tapering, not capitate; apical cell obtuse conical; calyptra none; cells 4-8 mic. in length; transverse walls covered by protoplasmic granules.

United States. (Farlow). Margins of wayside ditches and the like. (Wolle). **Rhode Island.** Geneva. (Bennett). **South Carolina.** On moist earth. (Ravenel). **Montana.** On bottoms of dried alkali ponds. Billings. September 1898. (Williams and Griffiths). **Washington.** On a dripping water pipe. Seattle. May 1901. (Gardner).

199. *Phormidium corium* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 192. pl. 5. f. 1, 2. 1893. De Toni. Syll. Algar. 5: 235. 1907.

Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 304. 1897. Tilden. American Algae. Cent. IV. no. 399. 1900. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 185. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate IV. fig. 71, 72.

Plant mass widely expanded, membranaceous, leathery, dark blue-green or black; filaments elongate, more or less flexuous, densely entangled; sheaths thin, papery, or diffuent into an amorphous mucus; trichomes 3-4.5 mic. in diameter, not constricted at joints; apex of trichome straight, briefly tapering, not capitate; apical cell obtuse conical; calyptra none; cells 3.4-8 mic. in length; transverse walls not granulated, usually conspicuous; cell contents sometimes granular, blue-green.

Greenland. (Börgesen). Massachusetts. On cliff. Middlesex Fells. (Collins). Connecticut. On stonework of dam at R. R. crossing. Bruce's Brook; on woodwork of dam, Island Brook, below Housatonic R. R.; on stonework of dam at Moody's Pond, May 1894, Bridgeport. (Holden). South Carolina. On rocks and timbers under dam at mill. Chester County. May 1898. (Green). Nebraska. In ponds. South Bend, Long Pine. (Bessey, Pound and Clements).

200. *Phormidium papyraceum* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 193. 1893. De Toni. Syll. Algar. 5: 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 14. no. 653. 1900. Tilden. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 493. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1004. 1903.

Plate IV. fig. 73, 74.

Plant mass expanded, glistening, thin, leathery, fragile when dried, dark green; filaments elongate, strongly flexuous, very densely entangled; sheaths thin, papery, sometimes diffuent; trichomes 3-5 mic. in diameter, not constricted at joints; apex of trichome straight, briefly tapering, not capitate; apical cell obtuse-conical; calyptra none; cells 2-4 mic. in length; transverse walls usually conspicuous, not granulated; cell contents sometimes granular, blue-green.

Maine. On stones at low water mark, outlet of fresh water brook, but within influence of tide. Cape Rosier. July 1901. (Collins). Massachusetts. In brook on stones under falling water. Medford. April 1896. (Collins).

Hawaii. On sides of wooden irrigation flume where water dripped through. Kahuku Plantation, Oahu. June 1900. (Tilden).

201. *Phormidium interruptum* Kuetzing. Tab. Phyc. 1: 33. pl. 45. f. 7. 1845.
De Toni. Syll. Algar. 5: 228. 1907.

Plate IV. fig. 75.

Plant mass membranaceous, mucous, blue-green; sheaths firm; trichomes 5-6.5 mic. in diameter, flexuously curved, interrupted; apex of trichome straight, obtuse; cells 2.5-3.2 mic. in length; transverse walls sometimes finely granulated; cell contents usually homogeneous, yellowish green.

Vermont. Charlotte. (Wolle).

202. *Phormidium naveanum* Grunow in Nave. Vorarbeiten zu einer Kryptogamenflora von Mährens. Verhandl. der Naturforsch. Vereins in Brünn. 40. 1864. De Toni. Syll. Algar. 5: 228. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879; Fresh-Water Algae U. S. 298. pl. 201. f. 1, 2. 1887.

Plate IV. fig. 76.

Plant mass thin, dull green becoming olive brown; filaments 15-18 mic. in diameter, more or less parallel; sheaths very wide, loosely cohering, firm, colorless; trichomes frequently interrupted; cells two or three times shorter than the diameter, indistinct; cell contents dull green.

Canada. Crystal Bay, Ontario, Lake Erie. (Wolle). **Pennsylvania.** Pools. (Wolle). **Florida.** Marsh grounds. (Smith).

203. *Phormidium retzii* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 195. pl. 5. f. 6-9. 1893. De Toni. Syll. Algar. 5: 241. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879; Fresh-Water Algae U. S. 302. pl. 202. f. 9-11. 1887. (*L. retzii* Ag., *L. papyrina* Kirchn.) **Bennett.** Plants of Rhode Island. 114. 1888. **Tilden.** American Algae. Cent. I. no. 70. 1894. List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 3. 1895. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 239. 1901. **Tilden.** American Algae. Cent. VI. no. 589. 1902. **Setchell and Gardner.** Algae of North-western America. Univ. Calif. Pub. Bot. 1: 185. 1903. **Collins.** The Algae of the Flume. Rhodora. 6: 230. 1904; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236, 243. 1905. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 640, 641. 1909.

Plate V. fig. 1-4.

Plant mass thick, compact, or sometimes forming penicillate or branched tufts, attached at base, upper portions floating, bright blue-green or dark lead color; filaments more or less straight, fragile, entangled; sheaths thin, fragile, usually soon diffuent into an amorphous mucus; trichomes 4.5-12 mic. in diameter, usually not constricted at joints, rarely somewhat monili-

form; apex of trichome straight, not capitate; apical cell scarcely tapering, truncate, with outer membrane scarcely thickened; cells 4-9 mic. in length; transverse walls not granulated, sometimes obscured by protoplasmic granules; cell contents granular, blue-green.

Newfoundland. On moss in stream, swift water, running into Torbay Harbor, Torbay. July 1897. (Holden). **New Hampshire.** On walls of the "Flume" and in quieter parts of the stream. (Collins). **Rhode Island.** Geneva. (Bennett). **Connecticut.** Forming dark bluish-purple gelatinous patches, often of considerable extent, on rocks in swiftly flowing current. Quinebaug River, Lisbon. September 1892. (Setchell). Stream just below paper mill. Pequonnock River; Rooster River, Bridgeport. June, July, September. (Holden). **Florida.** (Smith). **Alabama.** Auburn. March 1897. (Baker). **Texas.** 1902. (Fanning). **Wisconsin.** Forming membrane on sides of casing of spring. Osceola. September 1894. (Tilden). **Minnesota.** In ponds. Minnesota Point, Duluth. August 1901. (Tilden). **Washington.** Growing on a submerged log. Green Lake, Seattle. (Gardner). **West Indies.** In tufts on plants. Rio Cobre, Bog Walk, Jamaica. 1893. (Humphrey).

Forma fasciculatum Gomont. l. c. 197. De Toni. l. c. 243.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 26. no. 1254. 1905. Collins. Notes on Algae.—VII. Rhodora. 8: 122. 1906.

Fascicles attached at base, penicillate or tufted, branched, floating.

Massachusetts. In long masses in quick running water. Inlet of Walden Pond, Lynnfield. June 1905. (Collins).

Forma rupestris (Kuetz.) Gomont. l. c. 197. De Toni. l. c. 242.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879; Fresh-Water Algae U. S. 300. pl. 202. f. 58. 1887. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889.

Trichomes constricted at joints near the apices.

New Jersey. On rocks. Bergen, Palisades. (Wolle). **Maryland.** Forming a matted stratum on rocks. Garrett County. (Smith).

204. *Phormidium ambiguum* Gomont. Monogr. Oscill. 198. pl. 5. f. 10. 1893. De Toni. Syll. Algar. 5: 240. 1907.

Tilden. List of Fresh-Water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896; American Algae. Cent. II. no. 184. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 6. no. 254. 1897. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 185. 1903.

Plate V. fig. 5.

Plant mass more or less expanded, dark or yellowish green or blue-green; filaments elongate, flexuously curved, variously entangled; sheaths firm, or mucous and diffuent, at times thick and lamellose; trichomes 4-6 mic. in diameter, slightly constricted at joints; apex of trichome straight,

neither tapering nor capitate; apical cell rotund, with outer membrane slightly thickened; cells 1.5-2.7 mic. in length; transverse walls rarely granulated, occasionally obscured by protoplasmic granules; cell contents granular, blue-green.

Massachusetts. Forming a coating on stones and algae in ditch in salt marsh. Near Linden station. Revere. October 1892. (Collins). **Minnesota.** On bottom of wooden trough through which very cold spring water flows with a swift current. State Fish Hatcheries, St. Paul. September 1895. (Tilden). **Nebraska.** In aquaria. Lincoln. (Bessey, Pound and Clements). **Washington.** Growing on a submerged log. Green Lake, Seattle. (Gardner).

205. *Phormidium submembranaceum* (Ardissone and Strafforello) Gomont. Monogr. Oscill. 200. pl. 5. f. 13. 1893. De Toni. Syll. Algar. 244. 1907.

Collins, Holden and Setchell. Phyc. Bor-Am. Fasc. 24. no. 1162. 1904.

Plate V. fig. 6.

Plant mass membranaceous, leathery, dark green, sheaths not present; trichomes 5 mic. in diameter, constricted at joints, densely tangled, agglutinated by an abundant amorphous mucus; apex of trichome straight, gradually tapering, capitate; apical cell showing a depressed-conical calyptra; cells somewhat quadrate, 4-10 mic. in length; cell contents homogeneous, blue-green.

California. Forming a thick layer on plants just below water mark. Alameda. September 1903. (Osterhout and Gardner).

206. *Phormidium laysanense* Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 619. pl. 7. f. 4, 5. 1905. De Toni. Syll. Algar. 5: 245. 1907.

Plate V. fig. 7, 8.

Filaments 5-6 mic. in diameter; sheaths hyaline; trichomes 4-4.5 mic. in diameter, irregularly curved, very rarely straight, not constricted at joints; apex of trichome straight, gradually tapering; apical cell capitate; cells 4-11 mic. in length; transverse walls not granulated; cell contents blue-green.

Hawaii. On *Turbinaria*. Laysan. 1896-97. (Schauinsland).

207. *Phormidium favosum* (Bory) Gomont. Monogr. Oscill. 200. 1893. De Toni. Syll. Algar. 5: 245. 1907.

Dickie. On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. (*Hypheothrix obscura* Dickie). **Collins, Holden and Setchell.** Phyc. Bor-Am. Fasc. 3. no. 201. 1895. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896; American Algae. Cent. II. no. 185. 1896. **Collins.** Preliminary List of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Tilden.** Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 494. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 186. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 639. 1909.

Plate V. fig. 9, 10.

Plant mass moderately expanded, papery or thick, attached at base, floating, dark blue-green, when dried dark lead-colored; sheaths usually not present; trichomes 4.5-9 mic. in diameter, elongate, more or less flexuous, not constricted at joints, straight or somewhat spiral near the extremities, agglutinated by an amorphous mucus; apex of trichome gradually tapering, especially capitate; apical cell obtuse truncate, showing a somewhat hemispherical calyptra; cells 3-7 mic. in length; transverse walls marked by double rows of granules; cell contents blue-green.

Arctic Regions. Dried up pool, Distant Cape, Discovery Bay. (Dickie). Alaska. Floating or attached to wood in streams or on the ground. Glacier Valley, Unalaska. (Lawson). Juneau. (Setchell and Lawson). **Massachusetts.** (Farlow, Collins). **Rhode Island.** (Collins). **Connecticut.** Stratum adhering to rocks in shoal running water. Great Falls of the Housatonic, below Lovers' Leap. July. **New York.** On stones and earth in water flowing from a spring. Ithaca. April 1895. (Atkinson). **Texas.** 1900. (Fanning). **Wisconsin.** In trough. Osceola. August 1895. (Tilden). **Minnesota.** On sides of wooden tub. Long Lake, Hennepin County. September 1895. (Tilden). **Hawaii.** In running water in trough from rice field. Peninsula, Pearl City; on bottom of irrigating ditch in sugar cane field, Ewa Plantation, Oahu, June 1900. (Tilden).

208. *Phormidium calidum* Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 202. pl. 5. f. 16. 1893. De Toni. Syll. Algar. 5: 246. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 28. no. 1353. 1907.

Plate V. fig. 11.

Plant mass thin, membranaceous, dark green; sheaths not present, trichomes 6-8 mic. in diameter, parallel, somewhat straight, not constricted at joints, agglutinated by an amorphous mucus; apex of trichome straight, scarcely tapering, very slightly capitate; apical cell showing an oblique, depressed conical calyptra; cells 3-8 mic. in length; transverse walls not granulated; cell contents dull blue-green.

California. Forming a thin layer on rocks. Stow Lake, Golden Gate Park, San Francisco. May 1906. (Gardner).

209. *Phormidium subfuscum* Kuetzing. Phyc. Gen. 195. 1843. Gomont. Monogr. Oscill. 202. pl. 5. f. 17-20. 1893. De Toni. Syll. Algar. 5: 247. 1907.

Wolle. Fresh-Water Algae. U. S. 300. pl. 201. f. 11-13. 1887. [L. membranacea (Kg.) Thur.]. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 13. no. 605. 1899.

Plate V. fig. 12-15.

Plant mass widely expanded, pannose, thin, lamellose, dark green or dark olive; filaments straight, fragile, short, parallel, agglutinated; sheaths diffuent into a lamellose mucus; trichomes 5.5-11 mic. in diameter, not constricted at joints; apex of trichome straight, capitate, more or less briefly

tapering; apical cell showing a rotund or straight conical calyptra; cells 2-4 mic. in length; transverse walls sometimes showing two rows of granules; cell contents densely granular, dull blue-green.

Vermont. Charlotte. (Hosford). **Connecticut.** On rocks and boards, in old sluiceway. Still River, New Milford. May 1892. (Setchell). **Mexico.** Fields near Orizaba. (Müller).

Var. *joannianum* (Kuetz.) Gomont. l. c. 204. De Toni. l. c. 248.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. (Ph. joannianum Kg.) **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 8. no. 352. 1897.

Trichomes 5.5-7 mic. in diameter; apex of trichome often somewhat gradually tapering.

Rhode Island. Moshassuck River, near Woodlawn. April 1894. (Osterhout). **New York.** Old wood. Suffern. (Austin).

210. *Phormidium uncinatum* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 204. pl. 5. f. 21, 22. 1893. De Toni. Syll. Algar. 5: 250. 1907.

Dickie. On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. (*O. tenuis sordida* Kuetz.). **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896. **Tilden.** American Algae. Cent. III. no. 295. 1898. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 10. no. 452. 1898. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **Tilden.** American Algae. Cent. VI. no. 590. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 186. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905. **Tilden.** Notes on a Collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 154. 1908; American Algae. Cent. VII. Fasc. 1. no. 638. 1909.

Plate V. fig. 16, 17.

Plant mass widely expanded, adherent, thin and firm, or floating, attached at base, thicker, fringed, dark green, brown or black; filaments straight or somewhat flexuous; sheaths mucous, agglutinated, distinct or diffuent into an abundant amorphous mucus; trichomes 6-9 mic. in diameter, not constricted at joints; apex of trichome briefly tapering, curved or briefly spiraled, especially capitate; apical cell showing a rotund or depressed-conical calyptra; cells 2-6 mic. in length; transverse walls frequently granulated; cell contents blue-green.

Arctic Regions. Fresh water. 82° 27' N. (Dickie). **Alaska.** Forming more or less extended blue-black layers, either submerged or on the surface of the ground. St. Michael. (Setchell); near Iliuliuk, Unalaska; Orca. (Setchell and Lawson). **Greenland.** (Börjesen). **Maine.** On stones. Cromwell Harbor Brook, Bar Harbor. July 1896. (Collins). **Massachusetts.** In roadside pool. Valley Street. May 1908; running brook near Elm Street, Medford, Middlesex Fells. (Collins). **Connecticut.** Forming a purplish or copperish skin on stones in stream below dam at Moody's Pond;

Mill River, June, July, September. (Holden). **Minnesota.** On rocks under water fall, Bridal Veil Falls, Minneapolis. October 1901. (Hillesheim). **South Dakota.** In tank of artesian waters. Aberdeen. June 1896. (Griffiths). **Nebraska.** In aquaria. Lincoln. (Bessey, Pound and Clements). **Washington.** La Conner, Skagit County; Seattle. (Gardner). **Central America.** On rocks at edge of lake. Lake Amatitlan, Guatemala. January 1906. (Kellerman).

211. *Phormidium autumnale* (Agardh) Gomont. Monogr. Oscill. 207. pl. 5. f. 23, 24. 1893. De Toni. Syll. Algar. 5: 252. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 183. 1877. (*Ph. vulgare* Kg.); Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. (*Ph. vulgare publicum* Kg.); Fresh Water Algae. U. S. 310. pl. 206. f. 8. 1887. (*O. antliaria* Juerg.). **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. (*L. vulgaris* Kirchn.). **Bennett.** Plants of Rhode Island. 114. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. **Mackenzie.** A Preliminary List of Algae collected in the Neighborhood of Toronto. Proc. Can. Inst. III. 7: 270. 1890. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 22. pl. 1. f. 15. pl. 2. f. 22. 1894. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 9. no. 401. 1898. **Setchell.** Notes on Cyanophyceae. III. Erythea. 7: 53. 1899. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Tilden.** American Algae. Cent. VI. no. 591. 1902. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 23. no. 1104. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 186. 1903. **Börjesen and Jonsson.** The Distribution of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic. Botany of the Faeroes. Appendix. XXV. 1905. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 13. 1908.

Plate V. fig. 18, 19.

Plant mass expanded, fragile, glistening, dark blue-green, sometimes yellowish or dark-colored; filaments straight, rarely flexuous, entangled; sheaths narrow, fragile, mucous, distinct or diffuent into an amorphous mucus and agglutinated; trichomes 4-7 mic. in diameter, not constricted at joints; apex of trichome briefly tapering, straight or scarcely curved, especially capitate; apical cell showing a rotund calyptra; cells 2-5 mic. in length; transverse walls frequently granulated; cell contents blue-green.

Alaska. Forming a thin dark blue coating on small rocks in a rapid stream emptying into bay. Kukak Bay. (Saunders). Iliuliuk, Unalaska; Sitka. (Setchell and Lawson). **Canada.** Humber River. Toronto. (Mackenzie). **New Hampshire.** On mosses. Berlin Falls. (Farlow). **Massachusetts.** On stone drinking fountain. Revere. October 1897. (Collins). **Rhode Island.** Very common. (Bennett). Growing in a freshwater stream, on the surface of a rock frequently washed by salt water, and in a storm practically sub-

merged. Conanicut Island. August 1894. (Richards). New Jersey. On moist soil. (Wolle). Pennsylvania. On damp earth. (Wolle). Minnesota. Gull Lake. July 1893; on sides of stone basin over-flowed by spring water, between New Duluth and Fond du Lac, near Duluth, August 1901. (Tilden). Iowa. Iowa City. (Hobby). Damp soil. Grinnell. (Fink). Nebraska. On damp soil in greenhouse; around pumps, cisterns, Lincoln. (Saunders). Washington. Coupeville, Whidbey Island; La Conner, Skagit County; Seattle. (Gardner).

212. *Phormidium setchellianum* Gomont. Monogr. Oscill. 210. pl. 5. fig. 25, 26. 1893. De Toni. Syll. Algar. 5: 254. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 2. no. 52. 1895.

Plate V. fig. 20, 21.

Plant mass thin, cobwebby, dark purple, when dried dark lead-colored; sheaths delicate, usually diffuent into an amorphous mucus; trichomes 4-4.8 mic. in diameter, parallel, straight or moderately flexuous, not constricted at joints; apex of trichome scarcely tapering, curved or hooked, capitate; apical cell showing a depressed-conical calyptra; cells 3-6 mic. in length; transverse walls often showing a double row of granules; cell contents pale purple.

Connecticut. Forming arachnoid expansions on stones at the bottom of a swift brook. In the living condition the expansions are of the color of *Bangia fusco-purpurea*. Norwich. July 1890. (Setchell).

Genus *LYNGBYA* C. Agardh. Syst. Algar. XXV. 1824.

Filaments free, unbranched, free-floating or forming a densely intricate floccose or expanded mass; sheaths firm, of variable thickness, sometimes lamellose, colorless or rarely yellowish brown; trichomes sometimes constricted at the joints, either obtuse or slightly tapering at the apices; outer wall of apical cell sometimes thickened forming a calyptra.

I Trichomes not more than 2 mic. in diameter.

- 1 Plants living in salt water, epiphytic; transverse walls marked by two refringent granules

(1) Filaments 1.5 mic. in diameter; trichomes .5 mic. in diameter, cylindrical, not constricted at joints; cells 1.5 mic. in length
L. mucicola

(2) Filaments 1.5-2 mic. in diameter; sheaths very thin, scarcely visible; cells 2-7 mic. in length
L. perelegans

- 2 Plants living in fresh water

(1) Sheaths thin, colorless

A Filaments coiled or spiraled

a Filaments coiled; trichomes .8 mic. in diameter, constricted at joints; cells 2.3-3.2 mic. in length
L. rivulariarum

b Filaments more or less regularly spiraled, sometimes straight; trichomes 2 mic. in diameter; cells 1.2-3 mic. in length
L. lagerheimii

- B Filaments straight or curved
 - a Filaments 1.9 mic. in diameter; apex of trichome bluntly rounded; cells quadrate or a little longer than diameter
L. nana
 - b Filaments solitary and scattered; trichomes 1.5-1.8 mic. in diameter, somewhat flexuous; cells up to 3.6 mic. in length
L. subtilis
 - c Filaments 1.8 mic. in diameter, at first attached, afterwards free, short, straight or slightly curved; cells about equal in length to the diameter
L. distincta
- (2) Sheaths more or less thick and gelatinous
 - A Plant mass ochre-yellow in color; sheaths at first thin, colorless, later thick and yellowish; trichomes .9 mic. in diameter, especially constricted at joints, frequently interrupted
L. ochracea
 - B Plant mass rust-colored; sheaths at first thin, colorless, later thicker and rust-colored; trichomes .8-9 mic. in diameter, not constricted at joints, continuous
L. ferruginea
- II Trichomes 2-6 mic. in diameter; sheaths usually thin and colorless, sometimes becoming thick and yellowish
 - 1 Plants living in salt water, sometimes in brackish, fresh or hot water
 - (1) Filaments coiled, densely entangled; sheaths thin, colorless, later becoming thick and lamellose; trichomes 2.5-6 mic. in diameter, not constricted at joints; cells 1.5-5.5 mic. in length
L. lutea
 - (2) Plants living in salt water, epiphytic; sheaths thin, delicate; trichomes 3-4.5 mic. in diameter, constricted at joints; cells up to 13 mic. in length
L. holdenii
 - 2 Plants living in fresh water; sheaths usually thin and colorless
 - (1) Plant mass caespitose, light green; trichomes 2-3 mic. in diameter, not constricted at joints; cells 1-3.7 mic. in length
L. digueti.
 - (2) Plant mass caespitose, blue-green; sheaths delicate, smooth, usually inconspicuous; trichomes 3.2-3.5 mic. in diameter, somewhat rigid, forming tufts
L. penicillata
 - (3) Plant mass dull blue-green; trichomes 4-6 mic. in diameter, not constricted at joints; cells 2.3-3 mic. in length
L. aerugineo-caerulea
 - (4) Plants epiphytic; filaments straight or sharply curved and twisted; trichomes 5-6 mic. in diameter, not constricted at joints
L. cladophorae
 - (5) Plant mass at first adherent, afterwards free, rust-colored on the outside, olive green within; sheaths colorless, sometimes yellowish, slightly mucous and agglutinated, thick; trichomes 2.8-3.2

mic. in diameter, not constricted at joints; cells 2-6.4 mic. in length

L. versicolor

III Trichomes 5-60 mic. in diameter

1 Plants living in salt water, epiphytic; plant mass caespitose

- (1) Plant mass purplish-violet; trichomes 5-8 mic. in diameter; constricted at joints; cells 2.8-4.6 mic. in length; cell contents rose-colored *L. gracilis*

- (2) Plant mass dull blue-green; trichomes 6.5-8 mic. in diameter, constricted at joints; cells 2-4 mic. in length; cell contents pale blue-green *L. meneghiniana*

- (3) Plant mass dark or dull yellowish green; trichomes 14-31 mic. in diameter, evidently constricted at joints; cells 4-10 mic. in length; cell contents frequently showing scattered coarse granules, olive green *L. sordida*

2 Plants living in salt water; plant mass caespitose, extended, mucous, dull yellowish or dark green, when dried becoming dark violet; sheaths thick

- (1) Trichomes 5-12 mic. in diameter; apex of trichome slightly tapering, capitate; cells 2-3 mic. in length *L. semiplena*

- (2) Trichomes 9-25 mic. in diameter; apex of trichome not tapering, not capitate; cells 2-4 mic. in length *L. confervoides*

3 Plants living in salt, brackish, fresh or warm water or on moist earth

- (1) Trichomes 8-24 mic. in diameter; apex of trichome slightly tapering, capitate; apical cell truncate, rarely somewhat acute-conical; cells 2.7-5.6 mic. in length *L. aestuarii*

- (2) Trichomes 16-60 mic. in diameter; apex of trichome not tapering, not capitate; apical cell rotund; cells 2-4 mic. in length *L. majuscula*

4 Plants living in fresh water, often in hot or warm water

(1) Plant mass caespitose, dull or dark green or blue-green

- A Sheaths thickened and roughened with age; trichomes 6-10 mic. in diameter, not constricted at joints; apex of trichome not tapering, not capitate; cells 1.7-3.3 mic. in length

L. martensiana

- B Sheaths colorless, thin, papery; trichomes 7.5-13 mic. in diameter, especially constricted at joints; apex of trichome not tapering, not capitate; cells 3-10 mic. in length *L. putealis*

- C Sheaths colorless, thick, roughened; trichomes 11-16 mic. in diameter, not constricted at joints; apex of trichome slightly tapering, somewhat capitate; cells 2-3.4 mic. in length

L. major

- (2) Plant mass floating, olive green; filaments forming a regular loose spiral throughout the whole or a portion of their length; trichomes 14-16 mic. in diameter, not constricted at joints; cells 3.4-6.8 mic. in length *L. spirulinoides*

- (3) Plant mass formed of loosely entangled filaments, dark green;

filaments 15-19 mic. in diameter; trichomes 12.5 mic. in diameter;
cells very short L. arachnoidea

L. arachnoidea

Species not well understood.

L. bicolor

L. caeruleo-violacea

L. fluitans

L: hyalina

L. pusilla

L. rubra

L. rubro-violacea

213. *Lyngbya mucicola* Lemmermann. Plankt. Schwed. Gewäss. Ark. för Bot. 70. 1904. De Toni. Syll. Algar. 5: 289. 1907.

Lemmermann, Planktonalg. Ergebnisse einer Reise n. d. Pacific. 335.
1899; Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 619. 1905.

Filaments 1.5 mic. in diameter, scattered, epiphytic; trichomes .5 mic. in diameter, cylindrical, not constricted at joints; cells 1.5 mic. in length; transverse walls marked by two strongly refringent granules.

Hawaii. On *Chondrocystis schauinslandii*. Laysan.
(Schauinsland).

214. *Lyngbya perelegans* Lemmermann. Planktonalg. Ergebnisse einer Reise n. d. Pacific. 355. 1899. De Toni, Syll. Algar. 5: 289. 1907.

Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 619. 1905.

Plant mass epiphytic on marine algae; filaments 1.5-2 mic. in diameter, straight or curved; sheaths very delicate, scarcely visible; cells 2-7 mic. in length, somewhat quadrate or cylindrical; transverse walls marked by two glistening granules.

Hawaii. On marine algae. Laysan. (Schauinsland).

215. *Lyngbya rivulariarum* Gomont. Monogr. Oscill. 168. 1893. De Toni.
Syll. Algar. 5: 282. 1907.

Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 620. 1905.

Filaments very slender, twisted or coiled; sheaths colorless, very thin, papery; trichomes 7-8 mic. in diameter, constricted at the joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells 2.3-3.2 mic. in length; transverse walls pellucid; cell contents not granular, pale blue-green.

Hawaii. In a mass of *Nostoc*, in ditches. Between Honolulu and Waikiki, Island of Oahu. (Schauinsland).

216. *Lyngbya lagerheimii* (Möbius) Gomont. Essai Class. Nostocacées homocystées. Morot, Journ. de Bot. 4: 354. 1890; Monogr. Oscill. 167. pl. 4. f. 6, 7. 1893. De Toni. Syll. Algar. 5: 287. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 2. no. 53. 1895.
Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot.
 Club. 22: 430. 1895. **Collins.** Preliminary Lists of New England Plants.

—V. Marine Algae. Rhodora. 2: 42. 1900. Tilden. American Algae. Cent. VI. no. 587. 1902. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1008. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 187. 1903. West. West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904. Tilden. Notes on a Collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 154. 1908; American Algae. Cent. VII. Fasc. 1. no. 636. 1909.

Plate V. fig. 22, 23.

Filaments more or less regularly spiraled, sometimes straight; sheaths thin, hyaline; trichomes about 2 mic. in diameter; cells 1.2-3 mic. in length; transverse walls marked by two protoplasmic granules.

Maine. Forming a pale green sediment in water of a pool above high water mark, but reached by the spray. Pemaquid Point. July 1901. (Collins). **Massachusetts.** Little Pond, Falmouth. (Setchell). **Connecticut.** In brackish water in a small pool, near Norwich; in an aquarium, New Haven, November 1893. (Setchell). **Minnesota.** On rocks in running water in stone quarry. University campus. Minneapolis. November 1901. (Lilley). **Washington.** Among various filamentous algae. Whidbey Island; sulphur spring, Ravenna Park, Seattle. (Gardner). **Central America.** On branch of tree which had been cut off and thrown into water. Lake Amatitlan, Guatemala. January 1906. (Kellerman). **West Indies.** Near Bridgetown, Barbados. (Howard).

217. *Lyngbya nana* Tilden. American Algae. Century II. no. 179. 1896. De Toni. Syll. Algar. 5: 284. 1907.

Tilden. Some new Species of Minnesota Algae which live in a Calcareous or Silicious Matrix. Bot. Gaz. 23: 101. pl. 9. f. 5. 1897; List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 28. 1898.

Plate V. fig. 24.

Filaments 1.9 mic. in diameter, straight; sheaths delicate, hyaline, smooth; trichomes bluntly rounded at apices; cells 1-1.5 mic. in length; cell contents very pale steel color, or later in the season violet.

Minnesota. With other algae, forming a calcareous crust on sides of old wooden tank as far up as water line. Minneapolis. October 1895. (Tilden).

218. *Lyngbya subtilis* W. West. Algae of the English Lake District. Journ. Roy. Micr. Soc. 741. pl. 10. f. 58. 1892. De Toni. Syll. Algar. 5: 285. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 274. 1895. **West.** West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904. **Collins.** Notes on Algae. IX. Rhodora. 10: 162. 1908.

Filaments solitary and scattered; sheaths close, colorless; trichomes 1.5-1.8 mic. in diameter, somewhat flexuous, free swimming; cells up to twice as long as their diameter; cell contents homogeneous, pale blue-green.

Maine. In salt water pools. Ragged Island, near Cape Elizabeth. (Collins). **West Indies.** On bed of stream in crater of Grande Soufrière, Dominica. Bay Estate, Barbados. (Howard). **Hawaii.** (Volz).

219. *Lyngbya distincta* (Nordstedt) Schmidle. Algologische Notizen. IV. Allg. Bot. Zeit. 3: 58. 1897. De Toni. Syll. Algar. 5: 281. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 4. 1878. (*L. martensiana distincta* Nordstedt). Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 620. 1905. (*L. kützingerii distincta* (Nordst.) Lemm.).

Filaments 1.8 mic. in diameter, at first attached, afterwards free; short, straight or slightly curved; sheaths very thin, hyaline; apex of trichome not tapering, open; cells about equal to the diameter in length; cell contents delicately granular, blue-green.

Hawaii. Among filaments of *Pithophora affinis*. Hilo, Island of Hawaii. (Berggren). In ditches between Honolulu and Waikiki, Oahu. (Schauinsland). (Volz). Freshwater ditches, Punaluu, Hawaii. (Lauterbach).

220. *Lyngbya ochracea* (Kuetzing) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 279. 1875. Gomont. Monogr. Oscill. 169. 1893. De Toni. Syll. Algar. 5: 283. 1907.

Collins. Algae of Middlesex County, 14. 1888. Wittrock and Nordstedt. Algae Aq. Dulc. no. 1169. 1893. Saunders. Protophyta-Phycophyta. Flora of Nebraska, 22. pl. 2. f. 20. 1894. Tilden. American Algae. Cent. I. no. 68. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 1. no. 4. 1895. Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896. Tilden. American Algae. Cent. VI. no. 588. 1902. Setchell and Gardner. Algae of North-western America. Univ. Calif. Pub. Bot. 1: 187. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905. Brown. Algal Periodicity in certain Ponds and Streams. Bull. Torr. Bot. Club. 35: 247. 1908. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 13. 1908.

Plate V. fig. 25, 26.

Plant mass yellowish or ochre-yellow in color; filaments very slender, more or less curved, fragile; sheaths at first thin, colorless, later becoming thicker and yellowish; trichomes .9 mic. in diameter, especially constricted at joints; frequently interrupted; apical cell rotund; calyptra none; cells .6-.8 mic. in length; transverse walls not granulated.

Canada. Hanging in a thick, jelly-like, very fragile mass, from perpendicular bank of creek. Providence Cove, near Minnesota Seaside Station, Port Renfrew, Vancouver Island, British Columbia. July 1901. (Leavitt). **Massachusetts.** Cambridge. (Farlow). On stonework of dam. Saugus. June 1890; Cascade, Middlesex Fells; on rocks in stream, Beaver Brook. (Collins). **Connecticut.** Stream below paper mill; Factory Pond; outlet of Parrott's Pond, October, November; buoyed up in nebulous masses in quiet waters,

Bridgeport, November 1894. (Holden). **Pennsylvania.** (Wolle). **Indiana.** Edge of water-works reservoir, Bloomington. November 1906. (Brown). **Minnesota.** Floating in great abundance in creeks and ditches. State Fish Hatcheries, St. Paul. September 1894. (Tilden). **Iowa.** "In the trough of a flowing well. It is found very commonly in the waters in this locality that are laden with iron, the sheath becoming impregnated with this substance." (Buchanan). **Nebraska.** Floating in fragile, ochraceous masses. (Saunders).

221. *Lyngbya ferruginea* G. S. West. West Indian Freshwater Algae. Journ. of Bot. 42: 292. pl. 464. f. 20. 1904. De Toni. Syll. Algar. 5: 283. 1907.

Plate V. fig. 27-29.

Plant mass rust-colored; filaments 1.8-2.4 mic. in diameter; sheaths at first thin, colorless, later becoming thicker and rust-colored; trichomes .8-.9 mic. in diameter, not constricted at joints, continuous; apical cell cylindrical and obtuse; calyptra none; cells 4-5 mic. in length; transverse walls distinct, not granulated.

West Indies. Forming a yellow-brown ferruginous stratum. Roseau Valley, Dominica. (Howard).

222. *Lyngbya lutea* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 354. 1890; Monogr. Oscill. 161. pl. 3. f. 12, 13. 1893. De Toni. Syll. Algar. 5: 275. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 18. 1870-1877. (Ph. stragulum Crouan). **Wolle.** Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. (Ph. julianum Rab.) **Farlow.** Marine Algae of New England. 35. 1881. (L. tenerrima Thur.). **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Wolle.** Fresh-Water Algae. U. S. 301. pl. 202. f. 20, 21. 1887. (L. juliana Menegh.). **Collins.** Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. **Martindale.** Marine Algae of the New Jersey coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. **Collins.** Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 248. 1894; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 18. no. 854. 1901. **West.** West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904. **Börjesen and Jonsson.** The Distribution of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic. Botany of the Faeroes. Appendix. XXV. 1905. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 222. 1905.

Plate V. fig. 30, 31.

Plant mass somewhat gelatinous, leathery, yellowish brown or olive, when dried often becoming dark violet; filaments coiled, flexible, densely entangled; sheaths colorless, smooth, at first thin, later becoming thick

(3 mic.) and lamellose; trichomes 2.5-6 mic. in diameter, not constricted at joints; apex of trichome not tapering; apical cell showing a rotund calyptra; cells 1.5-5.5 mic. in length; transverse walls usually not distinct; cell contents granular, olive green.

Maine. Near outlet of Long Pond. (Collins). **Massachusetts.** On sand-covered rocks. Gloucester. (Davis). **Rhode Island.** At base of cliffs. Newport. (Farlow). On *Enteromorpha intestinalis* in pool at high water mark. Easton's Point, Newport. August 1901. (Simmons). **Connecticut.** On woodwork between tidemarks, below Yellow Mill bridge; on turfy bottom, Seaside Park; among *L. aestuarii*, Cook's Point; on sandy mud, Charles Island, May, July, October. (Holden). **New York.** Shores of Long Island, Jamaica Bay, College Point. Summer. (Pike). **New Jersey.** On wharves. Atlantic City. (Morse). **Florida.** (Smith). **Alabama.** Sandy soil, somewhat influenced by marine waters. (Wolle). **West Indies.** Guadeloupe. (Mazé). On roots of mangroves in brackish swamp. Near Bridgetown, Barbados. (Howard).

223. *Lyngbya holdenii* De Toni. Syll. Algar. 5: 260. 1907.

Collins. Preliminary Lists of New England Plants.—V. Marine Algae. *Rhodora*. 2: 42. 1900. (*L. subtilis* Holden). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1007. 1903; Phyc. Bor.-Am. Fasc. 24. no. 1163. 1904. Collins. Phycological Notes of the late Isaac Holden. —II. *Rhodora*. 7: 222. 1905.

Filaments attached by the middle to other algae, with free ends; sheaths thin, delicate; trichomes 3-4.5 mic. in diameter, constricted at joints; apex of trichome cylindrical or somewhat tapering; apical cell rounded; cells 3-13 mic. in length; cell contents pale green.

Maine. On bark of piles. Blake's Point. July 1898. (Collins). **Massachusetts.** On perpendicular and overhanging rocks. Marblehead Neck. June 1902. (Collins). On *Enteromorpha Magnolia*. September 1903. (Farlow). **Connecticut.** Seaside Park. December; attached to various marine algae, Bridgeport. (Holden).

224. *Lyngbya digueti* Gomont in Hariot. Algues du Golfe de Californie recueillies par M. Riguet. Journ. de Bot. 9: 169. 1895. De Toni. Syll. Algar. 5: 284. 1907.

Plant mass up to 2 mm. in thickness, caespitose, light green; filaments 2.5-3 mic. in diameter, very slender, twisted and entangled in basal portions, elongate, flexible, straight in upper portions; sheaths thin, colorless, papery; trichomes 2-3 mic. in diameter, not constricted at joints; apical cell rotund; calyptra none; cells 1-3.7 mic. in length.

Lower California. Adhering to insects, in fresh water. Near Santa Gertrudis. (Diguët).

225. *Lyngbya penicillata* Kuetzing. Diagnosen und Bemerkungen zu neuen oder kritischen Algen. Bot. Zeit. 194. 1847. De Toni. Syll. Algar. 5: 291. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 274. 1895.

Plant mass caespitose, dull blue-green; sheaths delicate, smooth, usually

inconspicuous; trichomes 3.2-3.5 mic. in diameter, somewhat rigid, entangled and twisted into loose fascicles with penicillate apices; transverse walls marked by granules.

West Indies. On bed of stream in crater of Grande Soufrière, Dominica. (Elliott).

226. *Lyngbya aerugineo-caerulea* (Kuetzing) Gomont. Monogr. Oscill. 166. pl. 4. f. 1-3. 1893. De Toni. Syll. Algar. 5: 281. 1907.

Jelliffe. A Preliminary List of the Plants found in the Ridgewood Water Supply of the City of Brooklyn, King's County, N. Y. Bull. Torr. Bot. Club. 20: 243. 1893. **Setchell.** Notes on Cyanophyceae.—I. Erythea. 4: 89. 1896. **West and West.** A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 289. 1898-1900. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 22. no. 1058. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 187. 1903. **Snow.** The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 28. no. 1355. 1907.

Plate V. fig. 32, 33.

Plant mass dull blue-green; filaments flexuous, fragile; sheaths colorless, firm, thin; trichomes 4-6 mic. in diameter, not constricted at joints, the portion protruding from the sheath very straight; apex of trichome occasionally capitate; apical cell depressed conical or rotund, showing a slightly thickened outer membrane; cells 2.3-3 mic. in length; transverse walls sometimes granulated; cell contents frequently coarsely granular.

Alaska. In a felt-like mass of filaments of *Vaucheria*. Juneau; in a small pond on an island in the Muir Glacier. (Saunders). **Massachusetts.** Forming a blackish encrustation near the water line, in a stone drinking trough. Woburn. September 1905. (Collins). In swamp. Medford. August 1906. (Lambert). **Connecticut.** Mt. Tom, Salisbury. (Setchell). **New York.** Ridgewood Water supply, Brooklyn. (Jelliffe). **Ohio.** Put-in-Bay, Lake Erie. (Snow). **California.** In an aquarium. Golden Gate Park, San Francisco. June 1902. (Osterhout and Gardner). **West Indies.** On leaves in warm stream, road to Roseau Lake (2500 feet); on ground (2000-300 feet) and in stream, crater of Grande Soufrière, Dominica. (Elliott).

227. *Lyngbya cladophorae* n. sp.

Plate V. fig. 34.

Plants epiphytic; filaments straight or sharply curved and twisted; sheaths delicate; trichomes 5-6 mic. in diameter, not constricted at joints; apical cell rotund; transverse walls indistinct; cell contents homogeneous, blue-green.

Hawaii. Growing on *Cladophora* filaments, in mountain stream. Waipio Valley, Hawaii. July 1900. (Tilden).

228. *Lyngbya versicolor* (Wartman) Gomont. Monogr. Oscill. 167. pl. 4. f. 4, 5. 1893. De Toni. Syll. Algar. 5: 282. 1907.

Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 429. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 2. no. 54. 1895. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 187. 1903. **West.** West Indian Fresh-water Algae. Journ. of Bot. 42: 291. 1904.

Plate V. fig. 35.

Plant mass at first adherent, afterwards free, lubricous, somewhat soft, rust-colored on the outside, olive green within; filaments long, twisted, closely entangled; sheaths up to 2 mic. in thickness, colorless, sometimes yellowish, slightly mucous and agglutinated; trichomes 2.8-3.2 mic. in diameter, not constricted at joints; apex of trichome neither tapering nor capitate; apical cell rotund; calyptra none; cells 2-6.4 mic. in length; transverse walls pellucid, sometimes granulated.

Alaska. Floating on a deep pool of fresh water. Glacier Valley, Unalaska. (Lawson). **Massachusetts.** Newton. (Collins). **Connecticut.** At first attached to stones, later rising in a verdigris-green mass. Shores of Lake Whitney, New Haven. October 1892. (Setchell). **West Indies.** On sides of basin of a fountain. Marine Garden, Kingston, Jamaica. April 1893. (Humphrey). Bay Estate, Barbados. (Howard).

229. *Lyngbya gracilis* (Meneghini) Rabenhorst. Fl. Eur. Algar. 2: 145. 1865. Gomont. Monogr. Oscill. 144. pl. 2. f. 20. 1893. De Toni. Syll. Algar. 5: 259. 1907.

Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. **Collins.** Notes on New England Marine Algae.—VII. Bull. Torr. Bot. Club. 23: 458. 1896; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 18. no. 853. 1901.

Plate V. fig. 36.

Plant mass caespitose, extensive, dense, floccose, lubricous, purplish violet, when dried often becoming colorless or dull yellow; filaments long, flexible, angular; sheaths close, smooth; trichomes 5-8 mic. in diameter, constricted at joints; apex of trichome not tapering; apical cell rotund, showing a slightly thickened outer membrane; cells 2.8-4.6 mic. in length; cell contents finely granular, rose-colored.

Maine. Among other algae on a mooring buoy that had been hauled up on the beach. Cape Rosier. July 1896. (Collins). **California.** On *Chaetomorpha aerea* in a pool. Pacific Beach. August 1901. (Snyder). **West Indies.** Guadeloupe. (Mazé).

230. *Lyngbya meneghiniana* (Kuetzing) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 354. 1890; Monogr. Oscill. 145. 1893. De Toni. Syll. Algar. 5: 260. 1907.

Lehmann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 620. 1905.

Plant mass up to 1 cm. in height, caespitose, fasciculate, mucous, dull blue-green; filaments long, somewhat straight, very flexible; sheaths thin, smooth; trichomes 6.5-8 mic. in diameter, constricted at joints; apex of

trichome not tapering; apical cell rotund, showing a slightly thickened outer membrane; cells 2-4 mic. in length; cell contents finely granular, pale blue-green.

Hawaii. On marine algae. Laysan. (Schauinsland).

231. *Lyngbya sordida* (Zanardini) Gomont. Monogr. Oscill. 146. pl. 2. f. 21. 1893. De Toni. Syll. Algar. 5: 260. 1907.

Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (*L. violacea* Menegh.). **Vickers.** Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 55. 1905.

Plate V. fig. 37.

Plant mass up to 3 cm. in height, caespitose, fasciculate, dark or dull yellowish green, when dried usually dark violet; filaments straight, somewhat rigid; sheaths smooth; trichomes 14-31 mic. in diameter, evidently constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells 4-10 mic. in length; cell contents frequently showing scattered coarse granules, olive green.

West Indies. Guadeloupe. (Mazé). Maxwell. (Vickers).

Forma *bostrychicola* (Crouan) Gomont. l. c. 146.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 26. 1870-1877. (*L. bostrychicola* Crouan). **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

Trichomes 14-20 mic. in diameter; cells up to 10 mic. in length.

West Indies. Guadeloupe. (Mazé).

232. *Lyngbya semiplena* (C. Agardh) J. Agardh. Algae maris Mediterraneae et Adriaticae. 11. 1842. Gomont. Monogr. Oscill. 158. pl. 3. f. 7-11. 1893. De Toni. Syll. Algar. 5: 273. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 31. 1865. (*L. sordida* Crouan). **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 21. 1870-1877. **Wolle.** Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Ph. congestum* Rabenh.) **Farlow.** Marine Algae of New England. 35. 1881. (*L. luteo-fusca* Ag.) **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Bennett.** Plants of Rhode Island. 95. 1888. **Collins.** Algae of Middlesex County. 14. 1888. **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (*L. luteo-fusca* Ag. and *L. schowiana* Kg.) **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. **Collins.** Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 248. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 5. 1895. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **Tilden.** Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub.

1: 187. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1059. 1903. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 620. 1905. Collins. Notes on Algae.—VII. Rhodora. 8: 123. 1906. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 30. no. 1452. 1908. Collins. Notes on Algae. IX. Rhodora. 10: 162. 1908.

Plate V. fig. 38.

Plant mass rarely beyond 3 cm. in height, caespitose, extensive, mucous, usually dull yellowish green or dark green, becoming dark violet when dried; filaments ascending from a decumbent and tangled base, soft, flexuous; sheaths up to 3 mic. in thickness, colorless, somewhat mucous, lamellose with age; trichomes 5-12 mic. in diameter, not constricted at joints; apex of trichome slightly tapering, capitate; apical cell showing a depressed conical or rotund calyptra; cells 2-3 mic. in length; transverse walls frequently granulated.

Maine. Growing in a rock pool reached only by the highest tides. Cape Rosier. July 1890; shore near Seal Harbor; in salt water pools, Ragged Island, near Cape Elizabeth. (Collins). **New Hampshire.** (Collins). **Massachusetts.** Wood's Holl. (Farlow). Mystic River salt marshes. (Collins). Falmouth. (Nott). Forming light yellow expansions on sandy shore at low water mark. Little Harbor, Wood's Hole. August 1894. (Setchell). **Rhode Island.** (Bennett, Collins). **Connecticut.** Growing in large patches on stones and woodwork between tidemarks. Stonington. (Bailey). Noank. (Farlow). **New York.** Shores of Long Island, Coney Island Creek. Summer. (Pike). **New Jersey.** Hudson, Hoboken. (Pike). On wharves between tide marks. Atlantic City. (Martindale). **Nebraska.** In pond. South Bend. (Bessey). **Washington.** Salt marsh. Whidbey Island. (Gardner). **California.** Pacific Beach. (Snyder). **Mexico.** Near Vera Cruz. (Müller). **West Indies.** Guadeloupe. (Mazé). **Hawaii.** Attached to rocks in tide pool filled at high tide. Waianae, Oahu. May 1900. (Tilden). On marine algae. Laysan. (Schauinsland).

233. *Lyngbya confervoides* C. Agardh. Syst. Algar. 73. 1824. Gomont. Monogr. Oscill. 156. pl. 3. f. 5, 6. 1893. De Toni. Syll. Algar. 5: 271. 1907.

Harvey. Nereis Boreali-Americana. Part III. 102. pl. 47. c. 1858. (*L. nigrescens* Harv.). **Schramm and Mazé.** Essai Class. Algues Guadeloupe. 31, 81. 1865. (*Leibleinia littoralis* Crouan, *L. caeruleo-violacea* Crouan). **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 21, 23, 26, 28, 30. 1870-1877. (*L. caeruleo-violacea* Crouan, *L. littoralis* Crouan, *Lyngbya cyanea* Crouan, *L. rufescens* Crouan, *L. rubro-violacea* forma *crassior* Crouan). **Farlow.** List of Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875; Marine Algae of New England. 35. 1881. (*L. luteo-fusca* Ag.). **Farlow, Anderson and Eaton.** Algae Am. Bor.-Exsicc. no. 48. 1876. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (*L. cyanea*

Crouan). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 6. no. 255. 1897. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1106. 1903. Collins. Phycological Notes of the late Isaac Holden.—I. Rhodora. 7: 172. 1905. Vickers. Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 55. 1905. Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 620. 1905. Collins. Notes on Algae. IX. Rhodora. 10: 160. 1908.

Plate V. fig. 39.

Plant mass about 5 cm. in height, caespitose, extended, fasciculate, mucous, dull yellowish or dark green, when dried becoming violet; filaments ascending from a decumbent and tangled base, long, straight, somewhat rigid; sheaths up to 5 mic. in thickness, colorless, later becoming lamellose and roughened on the surface; trichomes 9-25 mic. in diameter, not constricted at joints; apex of trichome not tapering nor capitate; apical cell rotund; calyptra none; cells 2-4 mic. in length; transverse walls usually granulated; cell contents olive or blue-green.

Maine. Salt marsh. Stover's Point, South Harpswell. (Collins.) **Massachusetts.** Common on *Zostera*. Summer. Wood's Holl. (Farlow). Gloucester. (Davis). **Rhode Island.** (Collins). **Connecticut.** On rocks and iron work. Stratford Shoals Light, Long Island Sound, near Bridgeport. October 1891. (Holden). **New York.** Sea shores or mud. Canarsie Bay, Long Island; on leaves of *Zostera*, Peconic Bay. (Hooper, Harvey). Prince's Bay, Staten Island; Canarsie, Bay Ridge, Long Island. (Pike). **South Carolina.** Charleston. (Farlow, Gibbs). **Florida.** On sand-covered rocks of a jetty, littoral. Anastasia Island. October 1902. (Howe). **Nebraska.** In culture from salt basin. Lincoln. (Bessey, Pound and Clements). **West Indies.** Guadeloupe. (Mazé). **Hawaii.** (Farlow).

Forma violacea Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. De Toni. Syll. Algar. 5: 703. 1907.

Cell contents violet.

West Indies. Manchioneal Bay, Jamaica. July 1900. (Pease and Butler).

234. *Lyngbya aestuarii* (Mertens) Liebman. Bemerkninger og Tillæg til den danske Algeflora. Krøyers Tidsskrift. 492. 1841. Gomont. Monogr. Oscill. 147. pl. 3. f. 1, 2. 1893. De Toni. Syll. Algar. 5: 262. 1907.

Harvey. Nereis Boreali-Americana. Part III. 102. pl. 47. B, F. 1858. (L. ferruginea C. Ag., L. fulva Harv.). Schramm and Mazé. Essai Class. Algues Guadeloupe. 32. 1865. (L. congesta Crouan). Farlow. List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875. Farlow, Anderson and Eaton. Algae. Am. Bor. Exsicc. no. 176. 1877. Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. (Ph. olivaceum Rab.). Wittrock and Nordstedt. Algae. Ag. Dulc. Exsicc. no. 282. 1879. (L. aestuarii aeruginosa Wolle). Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. (L. aeruginosa Ag.). Farlow. Marine Algae of New England. 34. 1881. Wolle. Fresh Water Algae. VI. Bull. Torr. Bot. Club. 9: 25. 1882. Pike. Check List of Marine

Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Wolle**. Fresh-Water Algae U. S. 296. pl. 200. f. 11-16, pl. 202. f. 1, 2. 1887. **Hay and Mackay**. List of the Marine Algae of the Maritime Provinces of Canada, with Notes. Trans. Roy. Soc. Can. 5: 1887. **Bennett**. Plants of Rhode Island. 114. 188. (*L. obscura* Kg., *L. interrupta* Kg.). **Collins**. Algae of Middlesex County. 14. 1888; Marine Algae of Nantucket. 4. 1888; Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. **Martindale**. Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale**. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608, 610. 1889. (Also *L. obscura* Wolle and *O. littoralis* Carm.) **Murray**. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (Also *L. compacta* Crouan). **Saunders**. Protophyta-Phycophyta. Flora of Nebraska. 21, 22. pl. 2. f. 25, 26. 1894. **Collins**. Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 247. 1894. **Tilden**. List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894. **Collins, Holden and Setchell**. Phyc. Bor.-Am. Fasc. 1. no. 6. 1895. **Collins**. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **Tilden**. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 488. 1901. **Collins**. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Setchell and Gardner**. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 186, 187. 1903. **Collins, Holden and Setchell**. Phyc. Bor.-Am. Fasc. 26. no. 1255. 1905. **Collins**. Phycological Notes of the late Isaac Holden.—I. Rhodora. 7: 172. 1905. **Vickers**. Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 45. 1905. **Lehmann**. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 620. 1905. **Collins**. Notes on Algae.—VII. Rhodora. 8: 123. 1906. **Buchanan**. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 13. 1908. **Collins**. Notes on Algae. IX. Rhodora. 10: 160, 162. 1908.

Plate V. fig. 40, 41.

Plant mass widely expanded, either forming a compact woolly layer on moist earth, or a floccose mass floating in water, blackish or dull blue-green; filaments long, flexible, (sometimes branched), strongly twisted and densely crowded, or moderately flexuous or somewhat straight and loosely entangled, sometimes forming erect fascicles in inundated places; sheaths at first colorless, thin, smooth, later becoming thick, roughened on the surface, lamellose, yellowish or brownish, with layers of different colors; trichomes 8-24 mic. in diameter, not constricted at joints; apex of trichome slightly tapering and capitate, truncate, rarely somewhat acute conical; apical cell showing a slightly thickened outer membrane; cells 2.7-5.6 mic. in length; cell contents finely granular, blue-green or olive.

Canada. Forming patches on other algae. Malpeque, Prince Edward Island. (Faull). In brackish pond, Pictou Harbor. (Mackay). **Maine**. Very common in lagoon. Little Cranberry Isle; occasional near Seal Harbor; salt marsh, Stover's Point, South Harpswell; in salt water pools, Ragged Island, near Cape Elizabeth. (Collins). **New Hampshire**. (Collins). **Massachusetts**. In quite fresh water, in old claypit. West Cambridge. August

1905; common in salt marshes. (Collins). Abundant in summer in shallow, brackish pools, covering exposed algae and *Zostera*. Gloucester. (Davis). **Rhode Island**. Pocasset, Neutakonkanut. (Bennett, Collins). **Connecticut**. Stonington. (Farlow). On the granite masses composing the breakwater at Stonington. (Bailey). Abundant in quiet brackish water, often forming felt-like sheets. Bridgeport; Cook's Point, Fresh Pond, June, July, September, October. (Holden). In a brackish pool beside the Thames River. Norwich. September 1892. (Setchell). **New York**. Shores of Long Island, Fort Hamilton, Bay Ridge. Summer. (Pike). **New Jersey**. In pools of moist earth subject to inundations from flowing tides; in ponds and pools in salt water marshes, Perth Amboy, Absecon. (Wolle). Brackish ditches at Hoboken. (Bailey). Common on marshes on floating eel-grass. Atlantic City. (Morse). In salt marshes about Newark Bay. (Pike). In salt ditches, Cape May. (Martindale). **Pennsylvania**. In small ponds. (Wolle). **Minnesota**. Gull Lake. July 1893. (Tilden). **Iowa**. In pond amid bladderwort. Eagle Grove. (Buchanan). **Nebraska**. In lakes and ponds in the eastern part of the state; in mineral water, Lincoln, Franklin. (Saunders). **West Indies**. Guadeloupe. (Mazé). Near Bridgetown; Bay Estate, Barbados. (Howard). In mats on stones. Kingston, Jamaica. April 1893. (Humphrey). Port Antonio, Jamaica. July 1891. (Pease and Butler). Near Kingston, Jamaica. (Duerden). **Hawaii**. In ditches between Honolulu and Waikiki, Oahu. 1896-97. (Schauinsland). Forming a skin growing closely attached to sand on rock. Laie Point, Koolauloa, Oahu. June 1900. (Tilden).

Forma *limicola* Gomont. l. c. 149. De Toni. l. c. 265.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 19. no. 903. 1902; Fasc. 29. no. 1402. 1907.

Plants living on damp soil, subject to inundation; plant mass pannose, compact, somewhat thin; filaments densely crowded and strongly twisted.

Massachusetts. Forming thin, black continuous sheets on the mud of a salt marsh. Bay Shore, Eastham. August 1907. (Collins). **Washington**. On mud in a salt marsh. Snakalum Point, Whidbey Island. (Gardner).

Forma *natans* Gomont. l. c. 149. De Toni. l. c. 265.

Tilden. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 489. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 19. no. 904. 1902.

Plant mass covered with water, at first attached to wet earth, later floating; filaments long, moderately flexuous or somewhat straight, loosely entangled.

Washington. Floating among *Ruppia* in a salt water pond. West coast of Whidbey Island. June 1901. (Gardner). **Hawaii**. In dirty tangled masses, floating in lagoon formed at mouth of river. Kealia River, Kauai. July 1900. (Tilden).

Forma *symplocoides* Gomont. Monogr. Oscill. 149. 1893. De Toni. l. c. 5: 265. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1009. 1903.

Plant mass not covered with water; filaments decumbent and entangled at the base, above forming erect, densely coalesced fascicles.

Massachusetts. On a muddy shore near high water mark. Mattapoisett. September 1902. (Collins).

Forma *ferruginea* Gomont. Monogr. Oscill. 150. 1893. De Toni. l. c. 5: 265. 1907.

Harvey. Nereis Boreali-Americana. Part III. 102. pl. 47 B. 1858. (*L. ferruginea* Ag.). **Kemp.** A classified List of Marine Algae from the Lower St. Lawrence. Can. Nat. and Geol. 5: 30. 1860. **Farlow.** List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875.

Plant mass dark brown; sheaths thick, lamellose, more or less intensely yellowish-brown.

Canada. On top of rocks near low water mark. Lower St. Lawrence. (Kemp). **New York.** On muddy shores, in tide pools and floating in ditches of salt or brackish water near the sea. Harlem River, close to the High Bridge. (Harvey). Salt ditches at Hoboken and near Greenport. (Bailley). Greenport, Long Island. (Farlow).

Forma *aeruginosa* (Ag.) Wolle in Wittrock and Nordstedt. Algae Aq. Dulc. Exsicc. no. 282. 1879. Gomont. l. c. 150. 1893. De Toni. l. c. 265.

Tilden. American Algae. Cent. VI. no. 586. 1902. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 19. no. 902. 1902.

Plant mass dark blue-green; sheaths somewhat thin, colorless.

New Jersey. On ground or in brackish ditches. August 1878. (Wolle). **Washington.** Floating in a salt water pond. West coast of Whidbey Island. June 1900. (Gardner). **Hawaii.** In shallow water of taro patch forming a bright blue-green continuous layer. Near Hauula Court House, Makao, Koolauloa, Oahu. June 1900. (Tilden).

235. **Lyngbya majuscula** (Dillwyn) Harvey in Hooker. English Flora. 5: part I. 370. 1833. Gomont. Monogr. Oscill. 151. pl. 3. f. 3, 4. 1893. De Toni. Syll. Algar. 268. 1907.

Harvey. Nereis Boreali-Americana. Part III. 101. pl. 47 A. 1858. **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 15, 22, 23, 24, 25. 1870-1877. (Also *O. corallicola* Crouan, *L. luteo-fusca* Crouan, *L. showiana* Crouan, *L. rigidissima* Crouan. **Farlow.** List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875. **Hall.** List of the Marine Algae growing in Long Island Sound. Bull. Torr. Bot. Club. 6: 112. 1876. **Dickie.** Supplemental Notes on Algae collected by H. N. Moseley, M. A., of H. M. S. Challenger, from various Localities. Journ. Linn. Soc. Bot. 15: 489. 1877. **Farlow.** Marine Algae of New England. 34. pl. 1. f. 4. 1881. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Hay and Mackay.** List of the Marine Algae of the Maritime Provinces of Canada, with Notes. Trans. Roy. Soc. Can. 5: 1887. **Moebius.** Ueber einige in Portorico gesammelte Süßwasser- und Luft-Algen. Hedwigia. 27: 246. 1888. **Hauck.** Meeresalgen von Puerto-Rico. Bot. Jahrb. 9: 470. 1888. **Bennett.** Plants of Rhode Island. 95. 1888. **Collins.** Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

(Also *L. erosa* Liebm., *L. anguina* Mont.). **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. **Anderson.** List of California Marine Algae, with Notes. Zoe. 2: 218. 1891. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 5. no. 202. 1896. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. **West and West.** A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 288. 1898-1900. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Tilden.** Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 492. 1901. **Vickers.** Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 55. 1905.

Plate V. fig. 42.

Plant mass up to 3 cm. in length, widely expanded, dark blue, dark blue-green, brownish or yellowish green; filaments very long, often curled, sometimes rolled in a circinate manner, rarely moderately flexuous; sheaths up to 11 mic. in thickness, colorless, later becoming very thick and roughened on the outside; trichomes 16-60 mic. in diameter, not constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells 2-4 mic. in length; transverse walls not granulated; cell contents finely granular, dull green, gray or lead-colored.

Canada. Pictou Harbor. (Mackay). Floating tufts, attached to other algae or to *Zostera*. Malpeque, Prince Edward Island. (Faull). **New Hampshire.** (Collins). **Massachusetts.** Wood's Hole; during the later summer months forming large tufts upon *Zostera* and various algae and often found floating free, Cape Cod. (Farlow). Washed ashore in large entangled masses. Wood's Hole. August 1894. (Setchell). **Rhode Island.** Providence. (Olney). (Collins). **Connecticut.** (Hall). **New York.** Canarsie, College Point, Long Island. Summer. (Pike). Long Island Sound. (Bailey). Peconic Bay. (Hooper). **New Jersey.** Newark Bay, Hudson River. (Pike). On eel-grass. Atlantic City. (Morse). Cape May. (Martindale). **Florida.** Key West. (Farlow, Harvey, Ashmead). **California.** On *Zostera*. Southern coasts. (Anderson). **Mexico.** (Liebman). **Bermudas.** (Rein). In shallow water. (Dickie). **West Indies.** (Hohenhacker). Guadeloupe. (Mazé). Grenada. (Murray). In warm springs. Los Baños, near Coamo; in river near Cayey; in Caguitas River, near Caguas, Porto Rico. 1885. (Sintenis). Forming a film on marine algae. Port Antonio, Jamaica. July 1891 (Pease and Butler) and March 1893 (Humphrey). Forming extensive tufts on muddy bottom, near the mouth of a small stream. Manchioneal Bay, Jamaica. July 1900. (Pease and Butler). Shallow bays, Anguilla. (Elliott). Barbados. (Vickers). **Hawaii.** Epiphytic on other algae, at low tide. Waianae, Oahu. May 1900. (Tilden).

236. *Lyngbya martensiana* Meneghini. Conspectus Algologiae euganeae. 12. 1837. Gomont. Monogr. Oscill. 165. pl. 3. f. 17. 1893. De Toni. Syll. Algar. 5: 279. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 31. 1865. (L.

arachnoidea Crouan). Mazé and Schramm. Essai Class. Algues Guadeloupe. 28. 1870-1877. (*L. thermalis* Crouan). Tilden. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 490. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 166. 1902. West. West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904. Tilden. Notes on a Collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 154. 1908; American Algae. Cent. VII. Fasc. 1. no. 637. 1909.

Plate V. fig. 43.

Plant mass caespitose, blue-green, when dried often becoming violet; filaments long, somewhat flexuous, flexible; sheaths colorless, becoming thickened and roughened with age; trichomes 6-10 mic. in diameter, not constricted at joints; apex of trichome not tapering, not capitate, apical cell rotund; calyptra none; cells 1.7-3.3 mic. in length; transverse walls inconspicuous or marked by protoplasmic granules; cell contents pale blue-green.

Central America. On stems of *Scirpus*, dead or dying, Lake Amatitlan, Guatemala. January 1906. (Kellerman). West Indies. Guadeloupe. (Mazé and Schramm). Near Bridgetown; Graeme Hall Swamp, Barbados. (Howard). Hawaii. On twigs under dripping water. Falls four miles from mouth of river. Waialuka River, Hilo. July 1900. (Tilden).

Var. *calcareo* Tilden. American Algae. Cent. II. no. 178. 1896; Some new species of Minnesota Algae which live in a calcareous or silicious matrix. Bot. Gaz. 23: 101. pl. 9. f. 4. 1897; List of fresh-water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 28. 1898. MacMillan. Minnesota Plant Life. 30. f. 8, 10. 1899. De Toni. Syll. Algar. 5: 280. 1907.

Plate V. fig. 44.

Plant mass forming extended strata throughout upper portions of calcareous deposit; filaments 6.5-7.5 mic. in diameter, straight, flexible, somewhat unequal in size; sheaths very distinct, colorless, smooth or rough; trichomes 5-6.5 mic. in diameter, not constricted at joints, frequently interrupted; apex of trichome not or very rarely tapering; cells about 2.5 mic. in length; cell contents dull blue-green, violet or rarely brown.

Minnesota. Forming a part of the lime encrustation which covers sides of wooden tank. Minneapolis. October 1895. (Tilden).

237. *Lyngbya putealis* Montagne. 2e centurie de Plantes cellulaires exotiques. Ann. Sci. Nat. Bot. II. 13: 200. 1840. Gomont. Monogr. Oscill. 163. pl. 3. f. 14. 1893. De Toni. Syll. Algar. 5: 277. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 31. 1865. (Also *Leibleinia torta* Crouan, *Lyngbya arachnoidea* Crouan, *L. putealis minor*). Mazé and Schramm. Essai Class. Algues Guadeloupe. 28, 30, 31. 1870-1877. (Also *L. rufescens* Crouan, *L. bicolor* Crouan, *L. torta* Crouan, *L. fusca* Crouan, *L. fontana*

Crouan, *L. fontana crassior* Crouan). Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901.

Plate V. fig. 45.

Plant mass up to 1 dm. in length, caespitose, widely expanded, elongate, penicillate, sometimes becoming dark violet or black; filaments very long, more or less flexuous and entangled at the base, above straight, parallel, rigid; sheaths colorless, thin, papery; trichomes 7.5-13 mic. in diameter, especially constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells 3-10 mic. in length; transverse walls sometimes granulated; cell contents granular, blue or blue-green.

West Indies. (Mazé and Schramm). Morant Bay, Jamaica. July 1900. (Pease and Butler).

238. *Lyngbya major* Meneghini. Conspectus Algologiae euganaeae. 12. 1837. Gomont. Monogr. Oscill. 164. pl. 3. f. 15. 1893. De Toni. Syll. Algar. 5: 279. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **West.** West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904.

Plate V. fig. 46.

Filaments caespitose, elongate, straight, rigid, dark green; sheaths colorless, thick, lamellose, roughened; trichomes 11-16 mic. in diameter, not constricted at joints; apex of trichome slightly tapering, somewhat capitate; apical cell showing a slightly thickened outer membrane; cells 2-3.4 mic. in length; transverse walls granulated; cell contents dark blue-green.

Florida. St. Lucia River. (Smith). **Nebraska.** In aquaria. Lincoln. (Bessey, Pound and Clements). **West Indies.** Guadeloupe. (Mazé). Morant Bay, Jamaica. July 1900. (Pease and Butler). Bay Estate, Barbados. (Howard).

239. *Lyngbya spirulinoides* Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 355. 1890; Monogr. Oscill. 166. pl. 3. f. 18, 19. 1893. De Toni. Syll. Algar. 5: 287. 1907.

Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 187. 1903.

Plate V. fig. 47.

Plant mass floating, olive green; filaments entangled, fragile, forming a regular loose spiral throughout the whole or a portion of their length, or sometimes straight throughout; distance between turns of spiral 73-108 mic.; sheaths colorless, thin, somewhat mucous, not lamellose; trichomes 14-16 mic. in diameter, not constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none; cells 3.4-6.8 mic. in length;

transverse walls sometimes marked by fine granules; cell contents somewhat homogeneous or finely granular, pale blue-green.

Nebraska. On moist earth. Lincoln. (Bessey, Pound and Clements).
Washington. Floating among various filamentous algae. Lake Washington, Seattle. (Gardner).

240. *Lyngbya arachnoidea* Kuetz. Sp. Algar. 282. 1849. De Toni. Syll. Algar. 5: 266. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 31. 1865. Mazé and Schramm. Essai Class. Algues Guadeloupe. 28. 1870-1877.

Plant mass dark green, becoming brownish or sometimes reddish; filaments 15-19 mic. in diameter, flexible, loosely entangled; sheaths colorless, transparent; trichomes 12.5 mic. in diameter, interrupted in lower portions; cells very short; cell contents granular, olive or blue-green.

• **West Indies.** In stagnant water. (Schomburgk).

Species not well understood.

241. *Lyngbya bicolor* Wood. Prodromus of a study of the fresh-water Algae of eastern North America. Proc. Am. Phil. Soc. 11: 124. 1869; Cont. Hist. Fresh-Water Algae North America. 22. pl. 1. f. 7. 1872. De Toni. Syll. Algar. 5: 290. 1907.

Plant mass a blackish or bluish-green mat; filaments variously curved, closely interwoven, simple; sheaths firm, transparent, in old filaments moderately thick; trichomes sometimes constricted at joints, often interrupted; cells short; transverse walls usually not visible; cell contents mostly very granular, light blue-green.

Pennsylvania. Forming dark waving tufts, a half-inch or more in height, adherent to bottom of stream, or to plants, sticks, etc. In shallow water of the Schuylkill River, near Spring Mills, Philadelphia. (Wood).

242. *Lyngbya caeruleo-violacea* Crouan in Schramm and Mazé. Essai Class. Algues Guadeloupe. 38. 1865. Mazé and Schramm. Essai Class. Algues Guadeloupe. 21. 1870-1877. De Toni. Syll. Algar. 5: 292. 1907.

Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

"Filamentis $\frac{1}{2}$ -1 cm. longis, in flocculos basim ad chordae ad instar convolutis, apice liberis, articulis subtiliter granulatis, diam. 5-plo brevioribus; strato siccitate violaceo-albido."

West Indies. Guadeloupe. (Mazé).

243. *Lyngbya fluitans* Hering in Krauss. Pflanzen des Cap- und Natal-Landes, gesammelt und zusammengestellt. Flora. 215. 1846. De Toni. Syll. Algar. 5: 290. 1907.

Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

"Filis aeruginosis, tenuissimis, flaccidis, in caespitem tripollicarem laxè implicatis."

West Indies. Guadeloupe. (Mazé).

244. *Lyngbya hyalina* Harvey. *Nereis Boreali-Americana*. Part III. 104. pl. 47 G. 1858. De Toni. Syll. Algar. 5: 293. 1907.

Farlow. List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875. Bennett. Plants of Rhode Island. 115. 1888. (*Microcoleus hyalinus* (Kg.) Kirchn.). Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

Plant mass forming indefinite, very soft and somewhat gelatinous continuous tufts or pilose strata; filaments attached by their bases, erect, straight, very slender, arachnoid, gelatinous-membranaceous, flaccid; transverse walls visible in older plants; cell contents granular, very pale yellowish green or nearly colorless.

Rhode Island. Davisville. (Bennett). Florida. On lime encrusted rocks. Key West. (Harvey).

245. *Lyngbya pusilla* Harvey. *Nereis Boreali-Americana*. Part III. 103. pl. 47 E. 1858. De Toni. Syll. Algar. 5: 293. 1907.

Farlow. List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875.

Plant mass minute, blackish green; filaments very slender, short, crisped, spreading in small bundles; sheaths very thin, colorless; transverse walls distinct; cell contents pale dull green.

South Carolina. Parasitic on small algae. Sullivan's Island. (Harvey).

246. *Lyngbya rubra* Crouan in Mazé and Schramm. *Essai Class. Algues Guadeloupe*. 29. 1870-1877. De Toni. Syll. Algar. 5: 293. 1907.

"Filamentis tenuissimis, in stratus maculiformes vel fasciculatos ad cm. longos consociatis, apice obtusis; articulis subquadratis, contentu subrubro repletis."

West Indies. Guadeloupe. (Mazé and Schramm).

247. *Lyngbya rubro-violacea* Crouan in Mazé and Schramm. *Essai Class. Algues Guadeloupe*. 29. 1870-1877. De Toni. Syll. Algar. 5: 293. 1907.

"Filamentis in fasciculos penicillatos, plus minusve in spiram convolutos, 1-2 cm. longos conjunctis; articulis subquadratis, contentu violaceo-obscuris, aetate provecta rubro."

West Indies. On madrepores. Guadeloupe. (Mazé and Schramm).

Genus *SYMPLOCA* Kuetzing. Phyc. Gen. 201. 1843.

Filaments branched, ascending from a prostrate base, agglutinated together in erect or anastomosing fascicles, or wick-like bundles, more or less procumbent, coalescing; false branches solitary; sheaths thin, colorless, firm or somewhat mucous; apex of trichome straight, sometimes a little tapering; outer membrane of apical cell slightly thickened in some species.

I. Plants living in salt water.

1. Fascicles erect

- (1) Plant mass blackish green; trichomes 4-2 mic. in diameter, constricted at joints throughout entire length *S. atlantica*

- (2) Plant mass dull or dark lead-colored; trichomes 6-14 mic. in diameter, constricted at joints near apices *S. hydroides*
2. Fascicles appressed; trichomes 1.5-3.5 mic. in diameter, especially constricted at joints *S. laete-viridis*
- II. Plants living on moist earth, or in fresh or hot water.
1. Trichomes 1-3 mic. in diameter
- (1) Plant mass deep blue-green; trichomes 1.2-2 mic. in diameter, sometimes constricted at joints *S. thermalis*
- (2) Plant mass compact, fibrous; trichomes 1.5-2.5 mic. in diameter, not constricted at joints *S. dubia*
- (3) Plant mass blue-green, changing to brown; trichomes 2-3 mic. in diameter *S. fuscescens*
2. Trichomes 3-8 mic. in diameter
- (1) Fascicles short, erect, spine-shaped; trichomes 3.4-4 mic. in diameter, not constricted at joints; cells somewhat quadrate or shorter than the diameter *S. muralis*
- (2) Fascicles tapering from a broad base to a loose, somewhat penicillate apex; trichomes 5.6 mic. in diameter; cells a little longer than their diameter, after division shorter *S. borealis*
- (3) Fascicles elongate, usually procumbent, spine-shaped; trichomes 5-8 mic. in diameter, not constricted at joints; cells somewhat quadrate or longer than the diameter *S. muscorum*

248. *Symploca atlantica* Gomont. Monogr. Oscill. 129. pl. 2. f. 5. 1893. De Toni. Syll. Algar. 5: 302. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 28. no. 1356. 1907.

Plant mass fasciculate-caespitose, blackish green; fascicles up to 1 cm. in height, erect; filaments very densely entangled, free, unbranched; strongly and angularly twisted; sheaths thin, firm; trichomes 4-6 mic. in diameter, constricted at the joints throughout entire length; outer membrane of apical cell thickened into a depressed conical calyptra; cells 2-6 mic. in length; transverse walls conspicuous, pellucid, not granulated; cell contents scarcely granular, greenish yellow.

California. On ground moistened by salt water. Bay Farm Island, near Alameda. November 1905. (Gardner).

249. *Symploca hydroides* Kuetzing. Spec. Algar. 272. 1849. Gomont. Monogr. Oscill. 126. pl. 2. f. 1-4. 1893. De Toni. Syll. Algar. 5: 300. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 29. 1865. (*S. antillarum* Crouan). Mazé and Schramm. Essai Class. Algues Guadeloupe. 18. 1870-1877. (*O. hydrurimorpha* Crouan, *O. symplocarioides* Crouan). Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 203. 1895. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 222. 1905. Vickers. Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 55. 1905.

Plant mass fasciculate-caespitose, dull, rarely dark lead-colored; fascicles up to 3 cm. in height, erect, spine-shaped, often lighter colored at base on account of empty sheaths; filaments very densely entangled, somewhat agglutinated, sometimes branched, unequally and angularly twisted; sheaths thin, somewhat mucous; trichomes 6-14 mic. in diameter, often constricted at joints near the apices; apical cell slightly inflated; calyptra none; cells 5-14 mic. in length; transverse walls usually indistinct; cell contents granular, blue-green.

Massachusetts. (Collins). **Rhode Island.** (Collins). **Connecticut.** In Yellow Mill Pond. August. (Holden). **New York.** Forming extended patches on mud left bare at low tide in the bottom of a creek. Cold spring Harbor. July 1895. (Johnson). **West Indies.** Guadeloupe. (Mazé).

Var. *genuina* Gomont. l. c. 127.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 19. no. 905. 1902.
Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901.

Trichomes 6-8 mic. in diameter; cells equal to or somewhat longer than the diameter.

Washington. Growing on old logs in a small cove. Whidbey Island. June 1901. (Gardner). **West Indies.** On rocks in shallow water, in small patches, not abundant. Montego Bay and Manchioneal Bay, Jamaica. 1900. (Pease and Butler).

Var. *fasciculata* (Kuetz.) Gomont. l. c. 127. De Toni. l. c. 302.

Farlow. Marine Algae of New England. 184. 1881. (*S. fasciculata* Kuetz.). Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901.

Trichomes 8-14 mic. in diameter; cells scarcely as long as the diameter.

Rhode Island. On rocks between tide marks. Newport. (Farlow). **West Indies.** Montego Bay and Manchioneal Bay, Jamaica. (Pease and Butler).

250. *Symploca laete-viridis* Gomont. Monogr. Oscill. 129. pl. 2. f. 6-8. 1893.
De Toni. Syll. Algar. 5: 302. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 188. 1903.

Plate V. fig. 50.

Plant mass thin, fibrillose, light green or yellowish; fascicles up to 1 mm. in height, slender, appressed to substratum; filaments moderately flexuous, somewhat parallel, agglutinated, not branched; sheaths wide, somewhat mucous; trichomes 1.5-3.5 mic. in diameter, especially constricted at joints; apical cell conical; calyptra none; cells 2.5-6 mic. in length; cell contents not granular, light green.

Alaska. On mud-covered rocks near the upper tide limit. St. Michael. (Setchell). **Florida.** Key West, Gulf of Mexico. (Farlow).

251. *Symploca thermalis* (Kuetzing) Gomont. Monogr. Oscill. 134. pl. 2. f. 15, 16. 1893. De Toni. Syll. Algar. 5: 307. 1907.

Tilden. American Algae. Cent. III. no. 294. 1898; Observations on some West American Thermal Algae. Bot. Gaz. 25: 98. pl. 9. f. 14. 1898.
Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 14. no. 652. 1900.

Plate V. fig. 51.

Plant mass fasciculate-caespitose, widely expanded, dark blue-green; fascicles up to 1 mm. in height, erect, approximate, somewhat thick; filaments sometimes branched, fragile, twisted and densely entangled at the base, above parallel, curled, closely crowded; sheaths very thin, sometimes mucous; trichomes 1.2-2 mic. in diameter, here and there constricted at joints; apex of trichome not tapering; apical cell rotund; calyptra none, cells 1.7-5 mic. in length; transverse walls inconspicuous, sometimes marked by two protoplasmic granules; cell contents homogeneous, rarely slightly granular, pale blue-green.

Canada. Forming extensive layers or knob-like masses on bottom of ditch. Natural Sulphur Springs, Banff, Alberta. August 1897. (Tilden).
New York. Adhering to bricks and stones in hot water from condensers of steam engines of the water works. Schenectady. June 1893. (Holden).

252. *Symploca dubia* (Naegeli) Gomont. Monogr. Oscill. 135. 1893. De Toni. Syll. Algar. 5: 308. 1907.

Plate V. fig. 52.

Plant mass compact, fibrous, widely expanded, fasciculate on the surface, yellowish, blue-green or gray, sometimes reddish on the surface, lighter colored within on account of empty sheaths; filaments coiled, entangled at the base, forming parallel fascicles; sheaths somewhat thick, firm, irregular in outline; trichomes 1.5-2.5 mic. in diameter, not constricted at joints; apical cell rotund; calyptra none; cells 3-8 mic. in length; transverse walls inconspicuous, sometimes marked by two granules; cell contents showing protoplasmic granules arranged in lines, pale blue-green.

Mexico. (Müller).

253. *Symploca fuscescens* (Kuetzing) Rabenhorst. Fl. Eur. Algar. 2: 153. 1865. De Toni. Syll. Algar. 5: 307. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879; Fresh-Water Algae U. S. 304. pl. 205. f. 8-12. 1887.

Plant mass blue-green, changing to brown; fascicles mucous, penicillate at the apex, obtuse; filaments agglutinated; sheaths mucous, scarcely conspicuous; cells somewhat quadrate; cell contents homogeneous or finely granular, pale olive or yellowish blue-green.

Pennsylvania. "Diameter of trichomes 2-3 mic." (Wolle).

254. *Symploca muralis* Kuetzing. Phyc. Gen. 201. 1843. Gomont. Monogr. Oscill. 132. pl. 2. f. 10. 1893. De Toni. Syll. Algar. 5: 304. 1907.

Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 429. 1895. **Collins.** Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896.

Plate V. fig. 53.

Plant mass continuous, widely expanded, shaggy, dark lead-colored; fascicles up to 2 mm. in height, spine-shaped, somewhat thick, erect; filaments elongate, twisted, irregularly entangled, closely crowded, decumbent

at the base, ascending in less flexuous, somewhat parallel fascicles, not branched; sheaths thin, firm, somewhat mucous below; trichomes 3.4-4 mic. in diameter, not constricted at joints; apex of trichome slightly tapering; apical cell obtuse conical; calyptra none; cells 1.5-4 mic. in length; transverse walls hardly visible, not granulated.

Massachusetts. Forming minute green, plush-like patches on ground. Near Black Rock, Middlesex Fells. (Collins). **Connecticut.** Occurring abundantly on flower pots in greenhouse. New Haven. (Setchell).

255. *Symploca borealis* Rabenhorst. Fl. Eur. Algar. 2: 156. 1865. De Toni. Syll. Algar. 5: 309. 1907.

Plant mass fasciculated, bright bluish or blue-green; fascicles 6-8 mm. up to 2.5 cm. in height, tapering from a broad lamelliform base up to a loose, somewhat penicillate apex; filaments 7-10 mic. in diameter, loosely agglutinated by a colorless mucus; sheaths close, sometimes swollen, homogeneous, very smooth, colorless, often empty in upper portions; trichomes 5-6 mic. in diameter, somewhat equal, slightly curved, erect, somewhat parallel, entangled, rarely interrupted; cells a little longer than their diameter, after division shorter; cell contents granular, bright blue-green.

Greenland. On *Bartramia ithyphylla* and *B. fontana*. (Breutel).

256. *Symploca muscorum* (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 354. 1890; Monogr. Oscill. 130. pl. 2. f. 9. 1893. De Toni. Syll. Algar. 5: 303. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 19, 29. 1870-1877. (*Ph. spadiceum* Crouan, *Ph. smaragdinum* Crouan, *L. graveolens* Crouan). **Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877; (*Ph. lyngbyaceum* Kuetz.). Fresh-Water Algae U. S. 299. pl. 201. f. 22-26. 1887. (*L. phormidium* Kuetz.). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. **Tilden.** American Algae. Cent. I. no. 66. 1894; List of fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 264. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 8. no. 353. 1897. **Setchell.** Notes on Cyanophyceae. III. Erythea. 7: 53. 1899. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 21: no. 1010. 1903. **Setchell and Gardner.** Algae Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 188. 1903. **West.** West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 25. no. 1208. 1905.

Plate V. fig. 54.

Plant mass fasciculate or mucous and *Phormidium*-like, extensive, blackish, dark green or blue-green; fascicles twisted, creeping, rarely erect, filaments flexible, densely crowded, at the base twisted and entangled, in upper portions less twisted, somewhat parallel; not branched; sheaths up to 2 mic. in diameter, firm, tenacious, or more or less mucous; trichomes

5-8 mic. in diameter, not constricted at joints; apical cell rotund or obtuse conical; calyptra slightly thickened; cells 5-11 mic. in length; transverse walls usually inconspicuous, not granulated; cell contents granular, blue-green.

Massachusetts. On moist earth by roadside. Malden. July 1904. (Collins). **New Jersey.** On marsh bottoms. (Wolle). **Pennsylvania.** On old logs partially submerged. (Wolle). **Maryland.** Forming tufts in an old brickyard. Baltimore. November 1896. (Humphrey). **Minnesota.** On trunk of tree-fern. University greenhouse. Minneapolis. November 1894. (Tilden). **Washington.** Among mosses on damp ground. Newhall, Orcas Island. (Gardner). **California.** In a greenhouse. Mount View Cemetery, Oakland. July 1902. (Gardner). **West Indies.** (Mazé and Schramm, Ramon de la Sagra). Bay Estate, Barbados. (Howard).

Var. rivularis (Wolle) Tilden. *American Algae. Cent. I. no. 67. 1894.* (*L. phormidium rivularis* Wolle). Wolle. *Fresh-Water Algae U. S. 299. 1887.* De Toni. *Syll. Algar. 5: 304. 1907.*

Johnson and Atwell. *Fresh Water Algae. Northwestern University. Report Dept. Nat. Hist. 21. 1890.* **Tilden.** *List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895.*

Plant mass forming dirty aeruginous tufts 25 mm. long; filaments 10 mic. in diameter; cells 2.5-5 mic. in length; cell contents dark steel blue or in portions yellowish green.

Pennsylvania. River Lehigh, Bethlehem. (Wolle). **Illinois.** Running water. Big Wood, Cook County. April. (Johnson and Atwell). **Minnesota.** Attached to stones in aquarium in Zoological laboratory. University of Minnesota, Minneapolis. November 1894. (Tilden).

Genus PORPHYROSIPHON Kuetzing.

Tab. Phyc. 2: 7. pl. 27. f. 1. 1850-1852.

Filaments unbranched; sheaths firm, solid, lamellose, usually purple or flesh-colored; trichomes solitary within the sheath; apical cell not capitate.

257. *Porphyrosiphon notarisii* (Meneghini) Kuetzing. *Tab. Phyc. 2: 7. pl. 27. f. 1. 1850-1852.* Gomont. *Monogr. Oscill. 69. 1893.* De Toni. *Syll. Algar. 5: 314. 1907.*

Tilden. *American Algae. Cent. I. no. 65 b. 1894.* **Collins, Holden and Setchell.** *Phyc. Bor.-Am. Fasc. 9. no. 402. 1898.* **West and West.** *A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 288. 1898-1900.*

Plate V. fig. 55.

Plant mass expanded, cushion-shaped, dark purple; filaments variously curved, densely entangled; sheaths purple, often colorless at the apex, sometimes showing layers of different colors, the outer ones colorless, firm, finally becoming very thick, lamellose, with the apex tapering and fibrillose; trichomes 8-19 mic. in diameter, usually constricted at joints;

apical cell tapering, obtuse; cells 4.5-12 mic. in length; cell contents granulated, blue-green.

North America. (Trécul, Anderson). **South Carolina.** On clayey soil in damp "Black-jack" woods. Chester. January 1898. (Green). **West Indies.** (Lenormand).

Genus **HYDROCOLEUS** Kuetzing. Phyc. Gen. 196. 1843.

Plant mass forming a caespitose cushion, very rarely hardened with calcium carbonate, or caespitose but somewhat indefinite, or even not at all caespitose, but Phormidium-like; sheaths always colorless, cylindrical, somewhat lamellose, more or less mucous or somewhat amorphous, later entirely diffuent; trichomes few within the sheath, often loosely aggregated; apex of trichome straight, more or less tapering, capitate; outer membrane of apical cell thickened into a calyptra; cells shorter than the diameter of the trichome, in some species very short.

I Plants living in salt water.

1 Plant mass caespitose

- (1) Plant mass green becoming violet; sheaths cylindrical, moderately mucous; trichomes 14-21 mic. in diameter

H. comoides

- (2) Plant mass blackish green; sheaths irregular in outline, strongly mucous; trichomes 18-24 mic. in diameter

H. cantharidosmus

- 2 Plant mass caespitose or forming an expanded mucous stratum, blackish green; sheaths irregular in outline, strongly mucous or even entirely diffuent; trichomes 8-16 mic. in diameter

H. lyngbyaceus

3 Plant mass mucous

- (1) Plant mass yellowish brown or dull green; sheaths somewhat amorphous or entirely diffuent; trichomes 14-21 mic. in diameter

H. glutinosus

- (2) Plant mass pale blue-green; sheaths agglutinated, forming a diffuent, amorphous layer; trichomes 25-30 mic. in diameter

H. holdenii

II Plants living in fresh water

- 1 Trichomes 6-8 mic. in diameter; apex of trichome gradually tapering, evidently capitate; cells somewhat quadrate or one-half the diameter of the trichome in length

H. homoeotrichus

- 2 Trichomes 12 mic. in diameter; cells quadrate or two or three times shorter than the diameter

H. ravenelii

- 3 Trichomes 16-19 mic. in diameter; apex of trichome somewhat tapering, scarcely capitate; cells 2-5 times shorter than the diameter

H. heterotrichus

258. **Hydrocoleus comoides** (Harvey) Gomont. Monogr. Oscill. 73. pl. 12. f. 3-5. 1893. De Toni. Syll. Algar. 5: 315. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 22. 1870-1877. (*L. mucosa* Crouan). Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

Plate V. fig. 56.

Plant mass up to 1.5 cm. in height, cushion-shaped, hemispherical, caespitose, mucous, green becoming violet; filaments erect, often spirally twisted and entangled below, free and somewhat straight in upper portions, scarcely branched; sheaths wide, *Lyngbya*-like, regular in outline, lubricous, slightly mucous, sometimes lamellose and fibrillose, usually open at the end; trichomes 14-21 mic. in diameter, constricted at joints, few within the sheath, solitary in upper portion of filament; apex of trichome tapering, truncate; cells 3-5 mic. in length; transverse walls granulated.

Bermudas. On the coast. (Farlow). West Indies. Guadeloupe. (Mazé).

259. *Hydrocoleus cantharidosmus* (Montagne) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 353. 1890; Monogr. Oscill. 74. pl. 12. f. 6, 7. 1893. De Toni. Syll. Algar. 5: 316. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 27. 1870-1877. (*L. cantharidosma* Montagne, *L. agglutinata* Crouan, *L. latilimba* Crouan). Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. Vickers. Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. 1: 45. 1905.

Plate V. fig. 57.

Plant mass up to 2 cm. in height, caespitose, lubricous, in dried specimens adhering to paper, olive or dark blue-green; filaments somewhat straight, moderately branched; false branches appressed; sheaths sometimes twice as thick as the trichome, very mucous, irregular and roughened in outline, agglutinated when dried, sometimes lamellose, usually open at the apex; trichomes 18-24 mic. in diameter, not constricted at joints, few within the sheath, somewhat parallel, solitary in upper portion of filament; apex of trichome tapering, truncate; cells 2-4 mic. in length; transverse walls sometimes granulated.

West Indies. Guadeloupe. (Mazé). Barbados. (Vickers). Hawaii. Growing with other algae below high tide. Hanalei, Kauai. July 1900. (Tilden).

260. *Hydrocoleus lyngbyaceus* Kuetzing. Species Algar. 259. 1849. Gomont. Monogr. Oscill. 75. pl. 12, f. 8-10. 1893. De Toni. Syll. Algar. 5: 317. 1907.

Wolle. Fresh Water Algae. IV. Bull. Torr. Bot. Club. 7: 43. 1880; Fresh-Water Algae U. S. 299. pl. 201. f. 27-29. 1887. (*L. arenarium* (Kuetz.) Rab.). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900. Vickers. Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 45. 1905.

Plate V. fig. 58.

Plant mass caespitose or mucous, widely expanded, dark green; filaments adnate, unbranched at base, branched in upper portions; false branches numerous, somewhat appressed; sheaths wide, mucous, roughened in outline, tapering or often open at apex, sometimes entirely diffuent and agglutinated; trichomes 8-16 mic. in diameter, not constricted at joints, numerous at base of filament, spirally twisted and entangled, solitary in the branches; apex of trichome tapering, truncate; cells 2.5-4.5 mic. in length; transverse walls granulated.

Massachusetts. (Collins). **New Jersey.** On moist low grounds near Atlantic City. (Wolle). **Florida.** (Smith). **Bermudas.** (Farlow). **West Indies.** Barbados. (Vickers).

Var. *a.* Gomont. l. c. 76.

Setchell. Notes on Cyanophyceae.—I. Erythea. 4: 89. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. no. 204. 1896.

Plant mass caespitose, usually epiphytic; sheaths somewhat firm.

Massachusetts. Very abundant on the fronds of *Ascophyllum nodosum* in the harbor. Woods Hole. Summer of 1904. (Nott, Setchell).

Var. *β* **rupestre** Kuetzing. l. c. 259. Gomont. l. c. 76. De Toni. l. c. 318.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 205. 1896. **Collins.** Notes on New England Marine Algae.—VI. Bull. Torr. Bot. Club. 23: 1. 1896. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900.

Plant mass expanded, mucous; sheaths entirely diffuent.

Maine. At first forming gelatinous sheaths on *Zostera* and *Ruppia*, afterwards floating masses, in warm water of tidal basin. Goose Cove, Rosier. July 1895. (Collins).

261. **Hydrocoleus glutinosus** (Agardh) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 353. 1890; Monogr. Oscill. 77. 1893. De Toni. Syll. Algar. 5: 318. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 30. 1865. (*O. fusco-rubra* Crouan). **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 15. 1870-1877. **Farlow.** List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875. (*L. nigrescens* Harv.). **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (*O. glutinosa* A. Br.). **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 10. no. 453. 1898. **Collins.** Preliminary Lists of New England Plants.—VI. Marine Algae. Rhodora. 2: 42. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905. **Vickers.** Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 45. 1905.

Plate V. fig. 59.

Plant mass not caespitose, mucous, indefinitely expanded or cylindrical in shape, yellowish brown or dull or yellowish green; sheaths very irregular in outline and somewhat amorphous, finally entirely diffuent;

trichomes 14-21 mic. in diameter, not constricted at joints; apex of trichome tapering, truncate; cells 2.5-3.5 mic. in length; transverse walls granulated.

Massachusetts. (Collins). **Connecticut.** Forming a *Phormidium*-like coating on iron pillars between tide marks. Black Rock Beacon, near Bridgeport. July 1892. (Holden). **New York.** Peconic Bay, Long Island. (Farlow). **West Indies.** Guadeloupe. (Mazé). Barbados. (Vickers).

262. *Hydrocoleus holdenii* Tilden. *Rhodora*. 3: 254. 1901. De Toni. Syll. Algar. 5: 319. 1907.

Holden. Two new species of Marine Algae from Bridgeport, Connecticut. *Rhodora*. 1: 197. pl. 9. f. 7, 8. 1899. (*H. majus* Holden). **Collins, Holden and Setchell.** *Phyc. Bor.-Am. Fasc.* 13. no. 602. 1899. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. *Rhodora*. 2: 42. 1900; *Phycological Notes of the late Isaac Holden.*—II. *Rhodora*. 7: 223. 1905.

Plate V. fig. 60, 61.

Plant mass mucous, tubular; dark blue-green; sheaths agglutinated, forming mostly an amorphous, gelatinous, diffuent mass, from which the outer extremities of the trichomes project, naked or enveloped in broad ragged sheaths, or the trichomes escape entirely and become independent; trichomes 25-30 mic. in diameter, not constricted at joints; apex of trichome tapering, truncate; apical cell showing evident calyptra; cells 3-6 mic. in length; transverse walls granulated; cell contents blue-green.

Connecticut. Forming gelatinous tubular coatings on old *Spartina* stems in ditches of a salt marsh. Bridgeport. May 1896; Cook's Point, May, September. (Holden).

263. *Hydrocoleus homoeotrichus* Kuetzing. *Phyc. Gen.* 196. 1843. Gomont. *Monogr. Oscill.* 82. pl. 13. f. 7-10. 1893. De Toni. Syll. Algar. 5: 323. 1907.

Wolle. Fresh Water Algae. III. *Bull. Torr. Bot. Club.* 6: 183. 1877. (*H. phormidioides* Bulnh.). **Setchell.** Notes on some Cyanophyceae of New England. *Bull. Torr. Bot. Club.* 22: 429. 1895.

Plate V. fig. 62, 63.

Plant mass caespitose, floating, indefinite, expanded, lead-colored or black; filaments simple or sparingly branched, flexuous, more or less flexible, entangled in tufts; sheaths lamellose, somewhat diffuent, cylindrical, roughened on the surface, transversely wrinkled, with open or pointed apex; trichomes 6-8 mic. in diameter, many within the sheath, parallel or twisted and entangled, sometimes solitary, not constricted at joints; apex of trichome gradually tapering, evidently capitate; apical cell depressed conical; cells 4-5.5 mic. in length; transverse walls frequently granulated; cell contents blue-green or lead-colored.

Connecticut. Growing in small short tufts on the posterior ends of shells of living fresh water mussels (*Anodonta*). Trading Cove Brook,

Norwich. (Setchell). **Pennsylvania.** On stones in rapid water; in sphagnum swamps. (Wolle).

264. *Hydrocoleus ravenelii* Wolle. Bull. Torr. Bot. Club. 6: 183. 1877. De Toni. Syll. Algar. 5: 322. 1907.

Plate V. fig. 64-65.

Plant mass dark violet or blue-green; filaments 15 mic. in diameter, those containing two or more trichomes proportionately wider; sheaths of younger plants close and colorless, those of older plants thicker and firmer, golden brown in color, lamellose, with ends usually empty and sharply pointed; trichomes 12 mic. in diameter, of equal thickness, solitary or two or three somewhat twisted together in a common sheath; cells somewhat equal, or two or three times shorter than the diameter; cell contents blue-green changing to golden brown or chestnut.

Texas. Pasture grounds. Houston. (Ravenel).

265. *Hydrocoleus heterotrichus* Kuetzing. Gomont. Monogr. Oscill. 80. pl. 13. f. 3, 4. 1893. De Toni. Syll. Algar. 5: 320. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879; Fresh-Water. U. S. 307. pl. 205. f. 2-5. 1887.

Plate V. fig. 66.

Plant mass about 5 mm. in height, caespitose, blackish; filaments adnate, short, in basal portion trunk-like, broadening out towards the apex, then divided and repeatedly branched; false branches more or less widely diverging, flexuous; sheaths somewhat close, somewhat mucous, irregular and roughened in outline, broadened out in middle portion of filament, gradually tapering towards the apex, pointed, open or closed, transversely wrinkled; trichomes 16-19 mic. in diameter, many within the sheath, closely aggregated, straight or spirally tangled and twisted, sometimes solitary, not constricted at joints; apex of trichome very slightly tapering, scarcely capitate, truncate; cells 3.4-4.5 mic. in length; cell contents finely granular.

Pennsylvania. In swamp. Near Bethlehem. (Wolle).

Genus **HYPHEOTHRIX** Kuetzing. Phyc. Gen. 229. 1843.

Plants living on moist earth or dripping rocks; filaments prostrate, commonly slightly branched, woven into a more or less compact mass; sometimes hardened with calcium carbonate; sheaths always colorless.

I Filaments very much twisted, scarcely flexible, ruptured if disentangled.

- 1 Plant mass thin, somewhat gelatinous, papery-membranaceous, very hard when dry, not encrusted with calcium carbonate; sheaths firm; trichomes 1-1.7 mic. in diameter, usually one or two within the sheath **H. calcicola**

- 2 Plant mass flocculent, waving, light fawn-colored; filaments 1.2-1.8 mic. in diameter; sheaths inconspicuous; transverse walls not visible **H. hinnulea**

- 3 Plant mass forming a small mat; filaments 1.5-2 mic. in diameter; sheaths closely adherent, entirely diffuent *H. glocephala*
- 4 Plant mass thin, cushion-shaped, mucous; filaments 1.8-2.2 mic. in diameter; sheaths close *H. herbacea*
- 5 Plant mass sometimes expanded, forming loosely interwoven masses or small cushion-shaped clusters; filaments 3.5-4 mic. in diameter; sheaths firm, close *H. tenax*
- 6 Plant mass somewhat spherical, hollow, tough, yellowish or light straw-colored; filaments 4-6 mic. in diameter; trichomes 1.5-2 mic. in diameter *H. bullosa*
- 7 Plant mass compact, leathery, brick-colored; filaments up to 7.5 mic. in diameter; sheaths wide, membranaceous, firm, homogeneous, smooth; trichomes 3.2-4 mic. in diameter, here and there interrupted *H. turicensis*
- 8 Plant mass more or less expanded, olive green; filaments 8-11 mic. in diameter; sheaths moderately wide; trichomes 3.5 mic. in diameter, here and there interrupted, often constricted at joints *H. aikensis*
- II Filaments long and flexible, disentangled without rupturing
 - 1 Plant mass encrusted with calcium carbonate; trichomes 1-1.7 mic. in diameter; cells longer than the diameter *H. coriacea*
 - 2 Plant mass not encrusted with calcium carbonate; trichomes 1.5-2 mic. in diameter; cells longer than the diameter *H. lardacea*
 - 3 Plant mass not encrusted with calcium carbonate; trichomes 1.5-3 mic. in diameter; cells longer than the diameter *H. arenaria*
 - 4 Plant mass compact, leathery, roughened; trichomes 2.3-2.8 mic. in diameter; cells a little shorter than the diameter *H. vulpina*
 - 5 Plant mass membranaceous, firm, smooth, pale rose or dark red; trichomes 5.6-8.3 mic. in diameter; cells somewhat quadrate *H. pallida*

266. *Hypheothrix calcicola* (Agardh) Rabenhorst. Fl. Eur. Algar. 2: 78. 1865. Gomont. Monogr. Oscill. 45. pl. 8. f. 1-3. 1893. (*Schizothrix calcicola* Gom.). De Toni. Syll. Algar. 5: 327. 1907.

Anderson and Kelsey. Common and conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 145. 1891. (*Leptothrix calcicola* Kg.). Saunders. Protophyta-Phycophyta. Flora of Nebraska. 21. pl. 2. f. 19. 1894. Tilden. American Algae. Cent. II. no. 180. 1896; (*P. purpurascens* (Kuetz.) Gom.); On some Algal Stalactites of the Yellowstone National Park. Bot. Gaz. 24: 197. pl. 8. f. 3, 4. 1897; Observations on some West American Thermal Algae. Bot. Gaz. 25: 98. 1898. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 557. 1899.

Plate VI. fig. 1-4.

Plant mass not encrusted with calcium carbonate, somewhat gelatinous, very hard when dry, papery-membranaceous, black or rarely yellowish blue-green; filaments short, very much twisted and entangled, rarely branched; sheaths firm, somewhat cartilaginous, tapering at the apex, at first somewhat close, cylindrical, enclosing one trichome, later becoming thicker, somewhat lamellose, irregular and roughened in outline, enclosing two or rarely many trichomes; trichomes 1-1.7 mic. in diameter, not constricted at joints; cells 2-6 mic. in length; transverse walls sometimes marked by two protoplasmic granules; cell contents pale blue-green.

Massachusetts. On walls of greenhouse. Botanic Garden, Cambridge. January 1899. (Collins). **Nebraska.** In greenhouse at the University. (Saunders). **Montana.** Common everywhere all the year, on damp or dripping rocks. (Anderson and Kelsey). **Wyoming.** Together with *Synechococcus aeruginosus* and *Gloeocapsa violacea*, forming black "stalactites," 1-1.5 dm. long and .5 dm. in diameter, or serrated, suspended masses or extended sheets. These hung from the top and lined the walls of a small cave in which was the vent of a hot spring. At short intervals they received jets of steam and a spray of hot water. Valley of Nez Perces Creek, Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden).

267. *Hypheothrix* (?) *hinnulea* (Wolle). De Toni. Syll. Algar. 5: 336. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877. (*Beggiatoa hinnulea* Wolle); Fresh-Water Algae U. S. 320. pl. 208. f. 5. 1887. **Tilden.** American Algae. Cent. I. no. 69. 1894. (*Lyngbya hinnulea* (Wolle) (Tilden); List of fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 235. 1895.

Plant mass flocculent, caespitose, waving, 6 mm. in thickness, light fawn-colored; filaments 1.2-1.8 mic. in diameter, 10-15 mm. in length, flexible and contractile; sheaths inconspicuous; transverse walls not visible; cell contents colorless or light yellowish brown.

Pennsylvania. In trenches for warm waste water from steam engines. (Wolle). **Minnesota.** Collected in masses around the inlet pipe in tanks in Zoological laboratory. University of Minnesota, Minneapolis. November 1894. (Tilden).

268. *Hypheothrix gloeophila* (Kuetzing) Rabenhorst. Fl. Eur. Algar. 2: 77. 1865. De Toni. Syll. Algar. 5: 331. 1907.

Plant mass forming a small mat; filaments 1.5-2 mic. in diameter, sometimes solitary, usually slightly curved and entangled; sheaths closely adherent, entirely diffuent; cells once and a half longer than their diameter; cell contents pale, almost colorless.

Greenland. (Richter).

269. *Hypheothrix herbacea* Kuetzing. Phyc. Gen. 199. 1843. De Toni. Syll. Algar. 5: 328. 1907.

Wolle. Fresh-Water Algae U. S. 320. pl. 208. f. 13. 1887. (*Leptothrix herbacea* Kg.).

Plant mass thin, somewhat cushion-shaped, mucous, bright green, more or less faded underneath; filaments 1.8-2.2 mic. in diameter, very slender, slightly flexuously curved, entangled; sheaths very close, colorless; cells here and there distinct.

South Carolina. Very abundant on the wood-work around the artesian well. Charleston. (Wolle).

270. *Hypheothrix tenax* Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 282. 1879; Fresh-Water Algae. U. S. 319. pl. 203. f. 2. 1887. (*Leptothrix tenax* Wolle). De Toni. Syll. Algar. 5: 329. 1907.

Plant mass sometimes expanded, forming loosely interwoven masses 1.5 dm. or more in diameter, at other times forming small, caespitose, cushion-shaped clusters; filaments 3.5-4 mic. in diameter, slender but strong and tough, often forming firm membranes; sheaths colorless, firm, close; transverse walls not always visible; cells about as long as wide; cell contents primarily light blue-green, soon changing to dull yellow or light brown.

Pennsylvania. On stones in stagnant water. (Wolle).

271. *Hypheothrix bullosa* Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877; Fresh-Water Algae U. S. 321. pl. 208. f. 19. 1887. (*Leptothrix bullosa* Wolle). De Toni. Syll. Algar. 5: 329. 1907.

Plant mass 4-8 mm. in diameter, somewhat spherical or oval, hollow, tough, gregarious, dilute straw color or yellowish white; filaments 4-6 mic. in diameter, unbranched, densely interwoven; sheaths colorless; trichomes 1.5-2 mic. in diameter; cell contents pale blue-green, often faded and contracted.

Pennsylvania. Shallow, sluggish water, Susquehanna River, Harrisburgh. (Wolle).

272. *Hypheothrix turicensis* Naegeli in Kuetzing. Spec. Algar. 269. 1849. De Toni. Syll. Algar. 5: 333. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877.

Plant mass compact, leathery, irregularly roughened, brick-colored, within faded or dull green; filaments up to 7.5 mic. in diameter; sheaths wide, membranaceous, firm, homogeneous, colorless, very smooth, tapering at apex; trichomes 3.2-4 mic. in diameter, thick, flexuously curved, here and there interrupted; cells a little shorter than the diameter; transverse walls sometimes indistinct; cell contents sometimes granular, dark or pale blue-green.

Pennsylvania. Moist rocks. (Wolle).

273. *Hypheothrix aikenensis* Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877. De Toni. Syll. Algar. 5: 329. 1907.

Plant mass more or less expanded, olive green; filaments 8-11 mic.

in diameter, tenacious, curved, very densely entangled; sheaths moderately wide, colorless, pellucid; trichomes 3.5 mic. in diameter, here and there interrupted, often constricted at joints; cells 3.5-7 mic. in length; cell contents pale blue-green.

South Carolina. Sluggish water. Aiken. (Ravenel).

274. *Hypheothrix coriacea* Kuetzing. Spec. Algar. 267. 1849. Gomont. Monogr. Oscill. 47. pl. 8. f. 6, 7. 1893. (*Schizothrix coriacea* Gom.). De Toni. Syll. Algar. 5: 336. 1907.

Dickie. On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 14. no. 654. 1900. (*Sch. coriacea* (Kg.) Gom.). **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 18. no. 855. 1901. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate VI. fig. 2.

Plant mass up to 1.5 cm. in thickness; widely expanded, encrusted with calcium carbonate, crustaceous, leathery, roughened on the surface, green becoming reddish, rose- or brick-colored on the outside, faded within; filaments very densely entangled, scarcely to be separated without rupturing, very long and soft, usually moderately branched; sheaths cylindrical, firm, somewhat close, slightly roughened, not lamellose, with very gradually tapering apices; trichomes 1-1.7 mic. in diameter, few within the sheath, somewhat parallel or solitary, constricted at joints; apical cell acute-conical; cells 3-6 mic. in length; transverse walls indistinct; rarely granulated; cell contents pale blue-green.

Arctic Regions. Walrus Island, 79° 15' N. (Dickie). **Connecticut.** Forming a felty stratum of yellowish or orange tint, on moist limestone rocks, shore of Housatonic River, near Gaylordsville. October 1898 and April 1899. (Holden). **California.** Mixed with other algae, forming a thin layer on the side of a watering trough. Dillon's Beach, Entrance to Tomales Bay, Marin County. December 1898. (Setchell and Gibbs). **West Indies.** In tufts on sides of lily tanks. Botanic Garden, Castleton, Jamaica. April 1893. (Humphrey).

Forma *meneghinii* Kuetzing. l. c. 268. De Toni. l. c. 337.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877.

Plant mass usually somewhat thick, pale red or flesh-colored; sheaths 2.8-4 mic. in thickness, up to four times thicker than the filaments.

New Jersey. Damp earth. (Austin).

275. *Hypheothrix lardacea* (Cesati) Hansgirg in Dalla Torre und Sarnth. Alg. v. Tyr. Vorarl. u. Liechtenst. 96. Gomont. Monogr. Oscill. 49. pl. 8. f. 8, 9. 1893. (*Schizothrix lardacea* Gom.). De Toni. Syll. Algar. 5: 340. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 105. 1895. (*S. lardacea* (Ces.) Gom.). **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 429. 1895. **Tilden.** American

Algae. Cent. II. no. 176. 1896; List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 28. 1898. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 396. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 20. no. 955. 1902. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate VI. fig. 3.

Plant mass up to 3 cm. in thickness, expanded, not encrusted with calcium carbonate, hard and elastic, composed of layers more or less uniform in color, dull or olive green or reddish; filaments soft, very long, twisted, not or but little branched, separated without rupturing; sheaths cylindrical, firm, contracted or pointed at the apex, at first close and smooth, finally becoming thicker and roughened; trichomes 1.5-2 mic. in diameter, few within the sheath, frequently solitary, somewhat parallel, in living specimens not constricted at joints; cells 2-3 mic. in length; transverse walls usually marked by protoplasmic granules; cell contents pale blue-green.

Alaska. Prince William Sound. June 1899. (Saunders). Forming blood-red gelatinous patches on smooth, wet, vertical rocks. Cascades, near Iliuliuk. June 1899. (Setchell and Lawson). Forming bright rose-red tufts on rocks exposed to fresh water spray. Near Orca, Prince William Sound. (Setchell). **Connecticut.** On vertical surface of dripping rock. East Rock, New Haven. November. (Holden). Forming rather gelatinous, rusty or dirty green patches on wet vertical faces of trap rock. East Rock, New Haven. December 1891. (Setchell). **Minnesota.** In a bottle of distilled water left standing for several months. Botanical Laboratory, University of Minnesota. 1896. (Determined by M. Gomont).

276. *Hypheothrix arenaria* (Berkeley). De Toni. Syll. Algar. 5: 342. 1907. Gomont. Monogr. Oscill. 50. pl. 8. f. 11, 12. 1893. (*Schizothrix arenaria* Gom.).

Plate VI. fig. 4.

Plant mass thin, somewhat fragile, not encrusted with calcium carbonate, blue-green; filaments firm, strongly flexuous, closely entangled, below trunk-shaped, towards the apex divided and branched; false branches strongly twisted and entangled; sheaths firm, roughened in outline, tapering at the apex, thick and lamellose in the lower parts; trichomes 1.5-3 mic. in diameter, few in the lower part of the filament, loosely aggregated, somewhat parallel, often solitary in the branches, constricted at the joints (in dried specimens); apical cell acute-conical; cells up to 5 mic. in length; cell contents pale blue-green.

United States. (Setchell).

277. *Hypheothrix vulpina* Kuetzing. Spec. Algar. 267. 1849. De Toni. Syll. Algar. 5: 338. 1907.

Dickie. On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880.

Plant mass compact, leathery, opaque, roughened, reddish or dull olive,

becoming darker in color; sheaths close, delicate, colorless; trichomes 2.3-2.8 mic. in diameter, slightly curved, loosely entangled; cells a little shorter than the diameter; transverse walls distinct, slightly granulated; cell contents pale becoming darker.

Arctic Regions. Marshy spots on land, 82° 27' N. (Dickie).

278. *Hypheothrix pallida* Kuetzing. Spec. Algar. 893. 1849. De Toni. Syll. Algar. 5: 339. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 182. 1877; Fresh-Water Algae U. S. 298. pl. 202. f. 26-31. 1887. (*L. pallida* (Naeg.) Wolle). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889.

Plant mass membranaceous, firm, somewhat smooth, pale rose or dark red in color; filaments 40-80 mic. (?Wolle) in diameter; sheaths very wide, at first homogeneous, finally becoming lamellose and fibrillose; trichomes 5.6-8.3 mic. in diameter, rather straight or slightly curved, somewhat parallel or sometimes flexuously curved and interwoven; cells somewhat quadrate, here and there slightly swollen; cell contents faded or yellowish brown.

New Jersey. Forming reddish-brown stratum on dry ground. (Austin). On wet soil and old meadow grounds. (Wolle).

Genus **SYMPLOCASTRUM** Gomont. Monogr. Oscill. 52. 1893.

Plants terrestrial or living on damp rocks; filaments twisted and entangled, ascending from a prostrate base, agglutinated together in erect fascicles; sheaths colorless.

- I Plant mass blue-green; trichomes 1.4-2 mic. in diameter, constricted at the joints; cells shorter than the diameter *S. fragile*
- II Plant mass flesh-colored or reddish; trichomes 1.6-2 mic. in diameter; cells usually longer than the diameter *S. rubrum*
- III Plant mass gray or yellowish; trichomes 1.9-2.3 mic. in diameter; cells longer than the diameter *S. cuspidatum*
- IV Plant mass blackish, olive or lead-colored; trichomes 3-6 mic. in diameter; cells somewhat quadrate or longer than the diameter *S. friesii*

279. *Symplocastrum fragile* (Kuetzing). De Toni. Syll. Algar. 5: 347. 1907. Gomont Monogr. Oscill. 52. pl. 8. f. 13, 14. 1893. (*Schizothrix fragilis* (Kg.) Gom.).

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 104. 1895. Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 429. 1895.

Plate VI. fig. 5.

Plant mass up to 1 mm. in thickness, pannose, tomentose, olive or blue-green; filaments flexuous, entangled, more or less parallel, finally becoming united into short, erect fascicles; sheaths irregular in outline, some-

what diffluent; trichomes 1.4-2 mic. in diameter, constricted at joints, at the base of the filament often numerous and closely crowded within the sheath; cells 1-2.5 mic. in length; protoplasm floccose, not granular, pale blue-green.

Connecticut. Forming a reddish, closely adherent crust on stones kept moist by the spray from a waterfall, by dam across Still River, Brookfield. May 1892. ("The red color was due to a unicellular organism associated with it"). (Setchell).

280. *Symplocastrum rubrum* (Meneghini) De Toni. Syll. Algar. 5: 350. 1907. Gomont. Monogr. Oscill. 53. pl. 8. f. 15, 16. 1893. (*Schizothrix rubra* Gom.).

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 189. 1903.

Plate VI. fig. 6.

Plant mass caespitose, flesh-colored, reddish or becoming dark colored; filaments elongate, divided and branched into numerous appressed portions, in lower parts twisted and entangled, above less flexuous, parallel, forming short, erect, pointed tufts at the apex; sheaths cylindrical, firm, wide, somewhat lamellose, slightly roughened on the surface, frequently transversely wrinkled at the base with a very long, pointed apex; trichomes 1.6-2 mic. in diameter, constricted at joints (in dried specimens), few or often solitary within the sheath; apical cell rotund; cells 2-3.5 mic. in length; transverse walls often granulated; cell contents pale reddish.

Alaska. Forming scum on deep pool of fresh water. Glacier Valley, Unalaska. (Lawson).

281. *Symplocastrum cuspidatum* (West and West). De Toni. Syll. Algar. 5: 349. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 273. pl. 16. f. 1-7. 1895. (*Symplocacuspdatum* W. and W.).

Plate VI. fig. 7-9.

Plant mass widely expanded, gray or yellowish; fascicles 8-15 mm. in height, erect, narrow, awl-shaped, aggregated, here and there dense, becoming bluish green; sheaths colorless, transparent or forming parallel layers, often roughened in outline, narrower and often branched at the apex; trichomes 1.9-2.3 mic. in diameter, flexuous, entangled, often interrupted, narrower in the mass, at the apex of the fascicles one to three included in the wide sheath, 13.5-25 mic. in diameter; cells 3.8-9 mic. in length; transverse walls distinct; cell contents blue-green.

West Indies. Specimens resembling *Sphagnum cuspidatum*. Occurring among mosses on trees. Summit of Trois Pitons (4500 feet), Dominica. (Elliott).

Var. luteo-fusca West and West. A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 288. 1898-1900. De Toni. l. c. 349.

Plant mass 1-2 mm. in height; rust-colored, dense; fascicles 4-10 mm. in height; sheaths 15-40 mic. in thickness, often surrounding two, three or many trichomes; trichomes 2.5-3.5 mic. in diameter.

West Indies. On rocks. Roseau Valley (1000-2000 ft.), Dominica; on bark, windward road to lake, Dominica; on the ground, mostly in old Diablotia holes, Morne Anglais (2300 ft.). (Elliott).

282. *Symplocastrum friesii* (Agardh) Kirchner in Engler and Prantl. Die natürlichen Pflanzenfamilien. I. 1. a. 68. f. 53. 1900. Gomont. Monogr. Oscill. 54. pl. 9. f. 1, 2. 1893. (*Schizothrix friesii* Gom). De Toni. Syll. Algar. 5: 347. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Symploca lucifuga* Bréb.); Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. (*Symploca friesiana* Kg.); Fresh-Water Algae U. S. 303. pl. 205. f. 8; 304. pl. 205. f. 13. 1887. **Moebius.** Ueber einige in Portorico gesammelte Süsswasser- und Luft-Algen. Hedwigia. 27: 246. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. II. no. 503. 1898. **Collins.** Notes on Algae. I. Rhodora. 1: 10. 1899.

Plate VI. fig. 10.

Plant mass indefinite, expanded, black or olive or lead-colored; filaments in lower portions twisted and entangled, in upper parts somewhat straight, parallel, dichotomously divided and branched into appressed portions, forming rigid; erect, spine-shaped tufts 3 cm. or more in height; sheaths cylindrical, firm, pointed at the apex, lamellose, smooth or a little roughened in outline; trichomes 3-6 mic. in diameter, evidently constricted at the joints, few or solitary within the sheath, parallel; apical cell truncate conical; cells 4-11 mic. in length; cell contents coarsely granular (except in apical cell).

Canada. On old wood. (Macoun). **United States.** (Farlow). **Maine.** On ground in woods at the base of Mount Kineo. July 1897. (Collins). **Massachusetts.** On damp ground. August 1898; abundant in paths and by roadsides. Lynnwoods, Middlesex Fells. 1899. (Collins). **New Jersey.** On shaded clay banks. Bergen. (Wolle). **West Indies.** Growing upon moss. On Mt. Jimenez, Sierro de Luquillo, Porto Rico. (Sintenis).

Genus **INACTIS** Kuetzing. Tab. Phyc. 1: 44. 1845-1849.

Plants growing in moist places or in rivers; filaments caespitose, often with numerous false branches, forming cushions which finally often become encrusted with calcium carbonate and hardened, zonate within, or aggregated into penicillate, floating fascicles; sheaths colorless or nearly so.

I Plant mass cushion-shaped, tufted

- 1 Plant mass strongly encrusted with calcium carbonate, stony; filaments straight, somewhat simple; trichomes 1-2 mic. in diameter; cells somewhat quadrate
I. *pulvinata*

- 2 Plant mass strongly encrusted with calcium carbonate, stony; filaments slender, simple in basal portions, fasciculately branched above; trichomes 1.4-3 mic. in diameter; cells somewhat quadrate or longer than the diameter *I. fasciculata*
 - 3 Plant mass cushion-shaped or crustaceous, not hardened with calcium carbonate; filaments forming trunk at base, very much branched in upper portions; trichomes 1-1.5 mic. in diameter; cells longer than the diameter *I. lacustris*
 - 4 Plant mass somewhat hemispherical, plano-convex; filaments more or less branched, growing in tufts; cells two or three times longer than broad *I. austini*
- II Plant mass forming penicillate fascicles, floating.
- 1 Plant mass submerged, attached; filaments very long; trichomes 1.4-2.4 mic. in diameter, constricted at joints *I. tinctoria*
 - 2 Plant mass submerged, epiphytic on other algae; trichomes 3-6 mic. in diameter, usually constricted at joints *I. simmonsiae*
 - 3 Plant mass submerged, attached; filaments very long; trichomes 6 mic. in diameter, constricted at joints *I. mexicana*
- III Filaments solitary, growing in gelatinous mass formed by other algae; trichomes 1.5-2 mic. in diameter, not constricted at joints *I. hawaiiensis*
283. *Inactis pulvinata* Kuetzing. Tab. Phyc. 1: 44. pl. 77. f. 3. 1845-1849. Gomont. Monogr. Oscill. 36. 1893. (*Schizothrix pulvinata* Gom.). De Toni. Syll. Algar. 5: 350. 1907.

Plate VI. fig. 11-13.

Plant mass cushion-shaped or crustaceous, stony, hardened with calcium carbonate, uneven or mammillate, blue-green on the outer surface, zonate within; filaments straight, rigid, parallel, coalesced or closely crowded, moderately branched; false branches entirely appressed; sheaths papery, with pointed apex; trichomes 1-2 mic. in diameter, constricted at joints, more or less numerous within the sheath; cells somewhat quadrate or twice as long as broad; cell contents pale blue-green.

North America. In cataracts. (Anderson).

284. *Inactis fasciculata* (Naegeli) Grunow in Rabenhorst. Fl. Eur. Algar. 2: 160. 1865. Gomont. Monogr. Oscill. 36. pl. 6. f. 1-3. 1893. (*Schizothrix fasciculata* Gom.). De Toni. Syll. Algar. 5: 351. 1907.

Murray. Calcareous Pebbles formed by Algae. Phyc. Mem. Part III. 74. pl. 19. 1895. Setchell. Notes on Cyanophyceae.—I. Erythea. 4: 89. 1896. Pennhallow. Note on Calcareous Algae from Michigan. Bot. Gaz. 21: 215. 1896. MacMillan. Minnesota Plant Life. 41. 1899. Tilden. American Algae. Cent. VI. no. 585. 1902. Powell. Observations on some Calcareous Pebbles. Minn. Bot. Studies. 3: 75. pl. 16. f. 8, 9; pl. 17. f. 1-5. 1903.

Plate VI. fig. 14, 15.

Plant mass cushion-shaped, stony, hardened with calcium carbonate, becoming confluent into a crustaceous, mammillate layer, blue-green, flesh-colored or brownish on the surface, zonate within; filaments slender, flexuous, closely entangled, forming a trunk-shaped basal portion narrower at the base, thicker above, branched and divided into many parts at the apex; false branches fasciculate, somewhat appressed; sheaths somewhat thick, with pointed apex; trichomes 1.4-3 mic. in diameter, constricted at the joints, many in the trunk-shaped basal portion, few or solitary in the branches; apical cell acute conical; cells 1.2-3.5 mic. in length; cell contents pale blue-green.

Connecticut. Mixed with other algae. Twin Lakes, near Salisbury. (Setchell). Michigan. Pebbles found in a pond on the shore of Lake Michigan. (Velie). Minnesota. Forming calcareous pebbles, which were found lying in from four to ten feet of clear water on sand-bars. Clearwater Lake, Wright County. June 1901. (Freeman and Lyon). "These pebbles range in size from that of a small hickory nut to two inches in diameter. Most of them are flattened, and though comparatively smooth in some cases, are often rough, corrugated and wave-worn. All are more or less hollow. In section they have a distinctly stratified appearance." * * * They "were found to be composed of a densely interwoven mass of filaments of which the most common type was that of *S. fasciculata* Gom."—Powell.

285. *Inactis lacustris* (A. Braun) De Toni. Syll. Algar. 5: 354. 1907. Gomont. Monogr. Oscill. 39. pl. 6. f. 9-12. 1893. (*Schizothrix lacustris* A. Br.).

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 712. 1900. Saunders. The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. 1901.

Plate VI. fig. 16.

Plant mass cushion-shaped or crustaceous, not at all or scarcely hardened with calcium carbonate, dull yellowish green; filaments flexuous, closely crowded, forming a trunk-shaped basal portion narrower at the base, broadened towards the apex, branched and divided into many parts at the apex; false branches twisted, entangled, or somewhat parallel; sheaths colorless, wide, very wide in the lower part of the filament; trichomes 1-1.5 mic. in diameter, constricted at the joints, many in the trunk-shaped basal portion, remote, often spirally twisted, few or solitary in the branches; cells up to 4 mic. in length; cell contents pale blue-green.

Alaska. In a fresh water pool. Near Prince William Sound. June 1899. (Saunders). Connecticut. On sandy ground near "Fresh Pond" (brackish). Stratford. December 1897. (Holden).

Var. *caespitosa* Gomont. l. c. 39. De Toni. l. c. 354.

Hauck and Richter. Phyk. Univ. no. 741. 1886-1889. (*S. lacustris caespitosa* Gom.). Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropoli-

tan Park Commission, Massachusetts. 126. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 206. 1896.

Filaments forming a very thick, trunk-shaped basal portion; false branches short.

Massachusetts. On stones along the margin of Spot Pond, Middlesex Fells; on stones at the water's edge, Peabody, Suntaug Lake, August 1890; Tynnfield, Suntaug Lake, September 1890. (Collins).

286. *Inactis austini* Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. De Toni. Syll. Algar. 5: 351. 1907.

Plant mass somewhat hemispherical, plano-convex, 3-7.5 mic. in diameter, often aggregated, diffuent, brown becoming blackish green; filaments firm, cylindrical; more or less branched, growing in tufts; sheaths colorless, very close; cells two or three times longer than broad; transverse walls usually distinct; cell contents dark blue-green.

New Jersey. Wet rocks. Little Falls. 1867. (Austin).

287. *Inactis tinctoria* (Agardh) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 379. 1875. Gomont. Monogr. Oscill. 41. pl. 7. f. 5-7. 1893. (*Schizothrix tinctoria* Gomont.). De Toni. Syll. Algar. 5: 356. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. (*Hydrocoleum tinctorium* A. Br.); Fresh Water Algae. Bull. Torr. Bot. Club. 6: 282. 1879. (*Hyphoethrix tinctoria* Rabenh.); Fresh-Water Algae U. S. 321. pl. 208. f. 16. 1887. (*Leptothrix tinctoria* Kg.). **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901.

Plate VI. fig. 17.

Plant mass continuous, soft, mucous, attached to submerged plants, blue-green or violet; filaments very long, flaccid, floating in free tufts, with penicillate apices, unbranched in lower portions, branched above; sheaths narrow, not lamellose, somewhat diffuent; trichomes 1.4-2.4 mic. in diameter, especially constricted at the joints, in basal part of filament numerous within the sheath, more or less spirally twisted, in the branches few and straight; apical cell rotund; cells 1.4-3 mic. in length.

Pennsylvania. On aquatic plants. (Wolle). **Nebraska.** On *Cladophora*. Fisher's Lake, Glen Rock. (Bessey, Pound and Clements).

288. *Inactis simmonsiae* (Collins) De Toni. Syll. Algar. 5: 356. 1907. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 707. 1900. (*Schizothrix simmonsiae* Collins). Collins. New Species, etc., issued in the Phycotheca Boreali-Americana. Rhodora. 8: 105. 1906.

Plants living in salt water; plant mass forming a brownish tufted coating on various algae (showing reddish brown when moistened, pinkish under the microscope); tufts 1-2 cm. long; sheaths thin, distinct; trichomes 3-6 mic. in diameter, much constricted at joints, usually single within the sheath, but often several in basal portion, sometimes irregularly swollen

and distorted as if doubling up in the sheath; cells .6-2 mic. in length; cell contents pale green.

Rhode Island. On algae in high rock pool. Easton's Point, Newport. December 1897. (Simmons).

289. *Inactis mexicana* (Gomont) De Toni. Syll. Algar. 5: 356. 1907. Gomont. Monogr. Oscill. 42. 1893. (*Schizothrix mexicana* Gom.).

Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901.

Plant mass continuous, soft, attached to submerged plants; filaments very long, flaccid, floating in free tufts, with penicillate apices, twisted, entangled, unbranched in lower portions, fasciculately branched above; false branches somewhat appressed; sheaths very thin, papery, not lamellose, somewhat roughened in outline; trichomes 6 mic. in diameter, constricted at joints, in basal part of filament numerous within the sheath, densely crowded, often twisted into a cord, in the branches few or solitary; apical cell scarcely tapering, rotund; cells 2-5 mic. in length; transverse walls commonly inconspicuous; cell contents showing scattered protoplasmic granules, pale violet (in dried specimens).

Mexico. In Guatulco River. (Gomont). **West Indies.** On rock in "Wag Water," Castleton, Jamaica. April 1893. (Humphrey).

290. *Inactis hawaiiensis* (Lemmermann) De Toni. Syll. Algar. 5: 357. 1907. Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 620. pl. 8. f. 19. 1905. (*Schizothrix hawaiiensis* Lemm.).

Plate VI. fig. 18.

Filaments 8-38 mic. in diameter, solitary, growing in gelatinous mass formed by other algae; false branches present; sheaths colorless, lamellose, with pointed apices; trichomes 1.5-2 mic. in diameter, not constricted at joints, parallel or flexuous, one to four within the sheath; cells 5-6 mic. in length; transverse walls not granulated, almost invisible; cell contents filled with vacuoles, pale blue-green.

Hawaii. With other algae in hot water. Volcano Mauna Kea, Island of Hawaii. (Schauinsland).

Genus **SCHIZOTHRIX** Kuetzing. Phyc. Gen. 230. 1843.

Plants living on moist earth or in water, or in inundated places, rarely entirely aquatic; filaments forming erect or prostrate, Symploca-like fascicles or a pannose stratum, rarely floating free; sheaths in the beginning colorless, finally becoming yellowish brown, purplish pink or bluish.

I Cells somewhat quadrate or shorter than the diameter.

- 1 Plant mass thin, encrusted, often widely expanded or in tangled tufts among other algae; sheaths colorless, very transparent; trichomes 1-1.5 mic. in diameter, constricted at joints; cells somewhat quadrate

S. hyalina

- 2 Plant mass caespitose or appressed, semiorbicular; sheaths very thick, lamellose; trichomes 4-9 mic. in diameter, usually solitary within the sheath *S. thelephoroides*
 - 3 Plant mass indefinite, sheaths purple, orange or rose-colored; trichomes 6-8 mic. in diameter, many within the sheath *S. purpurascens*
 - 4 Plant mass indefinite, woolly, lead-colored; sheaths very thick, lamellose; trichomes 7.5-8.5 mic. in diameter *S. chalybea*
 - 5 Plant mass not caespitose; sheaths yellowish orange; trichomes 7-13 mic. in diameter; cells somewhat quadrate or twice as short as the diameter *S. muelleri*
- II Cells longer than the diameter
- 1 Filaments very long; sheaths dark lead-colored, irregular in outline; trichomes 1.7 mic. in diameter *S. braunii*
 - 2 Filaments forming a loose, cobwebby mass within sandstone rock; sheaths cylindrical, rough, usually colorless and not lamellose, sometimes brownish and lamellose; trichomes 3.5-4.8 mic. in diameter; cells quadrate or a little longer than the diameter *S. rupicola*

291. *Schizothrix hyalina* Kuetzing. Spec. Algar. 320. 1849. De Toni. Syll. Algar. 5: 360. 1907.

Wolle. Fresh-Water Algae U. S. 307. pl. 203. f. 3, 4. 1887. (*Microcoleus hyalinus* (Kg.) Kirchn.). Bennett. Plants of Rhode Island. 115. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889.

Plant mass thin, encrusted, often widely expanded or in tangled tufts among other algae, blue-green or green; filaments 8 mic. in diameter; sheaths colorless, very transparent; trichomes 1-1.5 mic. in diameter, constricted at joints, very slender, curved and entangled, few within the sheath; apex of trichome awl-shaped, pointed; cells somewhat quadrate; cell contents pale green.

Rhode Island. Davisville. (Bennett). New Jersey. In ponds on *Sphagnum*. (Wolle). Pennsylvania. Wet rocks. (Wolle). South Carolina. Wet ground. (Wolle).

292. *Schizothrix thelephoroides* (Montagne) Gomont. Monogr. Oscill. 57. pl. 10. f. 1-4. 1893. De Toni. Syll. Algar. 5: 359. 1907.

Moebius. Ueber einige in Portorico gesammelte Süsswasser- und Luft-Algen. Hedwigia. 27: 247. pl. 9. f. 7. 1888.

Plate VI. fig. 19.

Plant mass pannose, caespitose or appressed, semiorbicular, rust-colored; filaments .5 cm. in height, divided and branched into appressed, somewhat dichotomous divisions, forming more or less spirally twisted tufts; sheaths firm, very thick, lamellose, the inner layers rust-colored, the outer ones colorless, very frequently dilated below the pointed apex, slightly roughened on the surface, transversely wrinkled; trichomes 4-9 mic. in diameter, usually solitary sometimes two within the sheath, parallel,

remote, evidently constricted at the joints; apical cell scarcely tapering, rotund; cells in lower portion of trichome up to double the diameter in length, in the upper portion somewhat quadrate, 6-14 mic. in length; cell contents coarsely granular, blue-green.

West Indies. Wet rocks. Summit of Mount Junque, Sierra de Luquillo, Porto Rico. (Sintenis).

293. *Schizothrix purpurascens* (Kuetzing) Gomont. Monogr. Oscill. 58. pl. 9. f. 6-8. 1893. De Toni. Syll. Algar. 5: 361. 1907.

Plate VI. fig. 20, 21.

Plant mass indefinite, expanded, dark violet; filaments moderately long, somewhat dichotomously divided and branched into more or less divaricate portions, in lower portions entangled, in upper parts forming somewhat parallel and twisted creeping tufts; sheaths purple, orange or rose-colored, transparent at the apex, firm, solid, very thick and especially lamellose, irregular and roughened in outline, with pointed apex; trichomes 6-8 mic. in diameter, usually constricted at the joints, numerous within the sheath, somewhat remote and parallel; apical cell conical, often sharply pointed; cells 3-8 mic. in length; cell contents coarsely granular (except in apical cell).

Var. *cruenta* (Lespinasse) Gomont. l. c. 59. De Toni. l. c. 362.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 11. no. 504. 1898. Collins. Notes on Algae.—I. Rhodora. 1: 10. 1899.

Sheaths purplish pink or peach-colored; trichomes usually constricted at joints.

Massachusetts. On moist ground near Winchester Reservoir, Middlesex Fells. August, September 1898. (Collins). **South Carolina.** (Ravenel).

294. *Schizothrix chalybea* (Kuetzing) Gomont. Monogr. Oscill. 57. pl. 9. f. 3-5. 1893. De Toni. Syll. Algar. 5: 359. 1907.

Plate VI. fig. 22.

Plant mass indefinite, woolly, lead-colored; filaments moderately long, branched, waving, loosely coalesced in erect tufts 2 mm. long; false branches somewhat dichotomous, appressed; sheaths very thick, lamellose, the inner layers pale lead-colored, the outer ones transparent, firm, cylindrical, smooth or a little roughened on the outside; trichomes 7.5-8.5 mic. in diameter, very much constricted at joints; few and parallel within the sheath, or often solitary; apical cell up to 11 mic. in length, obtuse or acute conical; cells 3-8 mic. in length; cell contents coarsely granular (except in apical cell), dark green in color.

Mexico. On mossy ground, near the Volcano of Orizaba. (Mueller).

295. *Schizothrix muelleri* Naegeli in Kuetzing. Spec. Algar. 320. 1849. Gomont. Monogr. Oscill. 59. pl. 10. f. 5-7. 1893. De Toni. Syll. Algar. 5: 362. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877.

(*Hydrocoleum versicolor* Rabenh.). Farlow. Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. (*Microcoleus versicolor* Thur.). Collins. Algae of Middlesex County. 15: 1888. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 1. no. 7. 1895. Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 126. 1896. Setchell. Notes on Cyanophyceae. III. Erythea. 7: 45. 1899. Collins. The Algae of the Flume. Rhodora. 6: 230. 1904.

Plate VI. fig. 23.

Filaments long, moderately flexuous, divided and branched into appressed portions, woven into an indefinite, expanded, dark or blackish green mass, or forming decumbent tufts attached to mosses, or floating free; sheaths yellowish orange, firm or somewhat diffuent, irregular in outline, with pointed apex, trichomes 7-13 mic. in diameter, slightly constricted at joints, solitary or few within the sheath; apical cell obtuse conical; cells 4-9 mic. in length; cell contents coarsely granular.

New Hampshire. Mt. Tumble-Down Dick. (Farlow). In thin black sheets on wall of the "Flume." (Collins). **Massachusetts.** Forming a black coating on wet rocks. Middlesex Fells; on perpendicular cliffs, forming sheets of considerable size, Saugus, April 1890, 1893. (Collins). **Connecticut.** Mount Carmel. (Setchell). **California.** Along the banks of a small stream on Howell Mt., near St. Helena, Napa County. February 1896.

296. *Schizothrix braunii* Gomont. Monogr. Oscill. 63. pl. 11. f. 9-13. 1893. De Toni. Syll. Algar. 5: 365. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 189. 1903.

Plate VI. fig. 24.

Plant mass crustaceous-floccose, adhering to paper when dried, blackish; filaments very long, densely tangled and twisted into cords, moderately branched; sheaths dark lead-colored, firm, slightly irregular in outline, not fringed, with very gradually tapering apex; trichomes 1.7 mic. in diameter, constricted at joints, few within the sheath, often solitary, distant, parallel; apical cell tapering, obtuse; cells 2-5 mic. in length; transverse walls granulated; cell contents pale blue-green.

Alaska. On dripping rocks. Near Iliuliuk. (Setchell and Lawson). Orca. (Jepson). "Most of the sheaths are colorless, but some are of the characteristic blue-black color of this species."—Setchell and Gardner.

297. *Schizothrix rupicola* Tilden. American Algae. Century II. no. 175. 1896; Some New Species of Minnesota Algae which live in a Calcareous or Silicious Matrix. Bot. Gaz. 23: 103. pl. 9. f. 9. 1897; List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 28. 1898.

Plate VI. fig. 25.

Filaments 9.6-16 mic. in diameter, forming a loose, cobwebby mass

within sandstone rock, as far at least as 10-15 mm. from surface; sheaths cylindrical, rough, usually colorless and not lamellose, but sometimes brownish and lamellose; trichomes 3.5-4.8 mic. in diameter, not constricted at the joints, one to many in a sheath; apical cell truncate conical; cells 5-8 mic. in length; transverse walls usually invisible.

Minnesota. In bare and dry sandstone cliffs. Soldiers' Home, Minnehaha Falls. September 1896. (Hall).

Genus **DASYGLOEA** Thwaites. Eng. Bot. pl. 2941. 1848.

Sheaths very wide, colorless or yellowish brown; trichomes very few within the sheath, very loosely aggregated; apex of trichome straight, not capitate; cells often longer than the diameter.

298. *Dasygloea amorpha* Berkeley in English Botany. pl. 2941. 1848. Gomon. Monogr. Oscill. 84. pl. 13. f. 11, 12. 1893. De Toni. Syll. Algar. 5: 368. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877; Fresh-Water Algae U. S. 304. pl. 204. f. 1-9. 1887. (*Microcoleus amorphus* (Thwaites) Wolle).

Plate VI. fig. 26.

Plant mass amorphous, gelatinous; filaments twisted, entangled, divided into fringes at the apex; sheaths transparent throughout, or dull yellow within, very irregular in outline, mucous, sometimes somewhat lamellose; trichomes 4-6 mic. in diameter, constricted at joints; apex of trichome sometimes very gradually tapered; apical cell truncate conical; cells 4-13 mic. in length; cell contents coarsely granular.

Pennsylvania. Forming a thin olive or dark blue-green membrane, skin-like, on trickling rocks in mountain ravine. Glen Onoko. (Wolle).

Genus **MICROCOLEUS** Desmazières.

Cat. des Plantes omises dans la Botanique Belgique. 7. 1823.

Plants living on soil, in fresh water or sometimes in salt water; filaments simple or vaguely branched, creeping on the ground, sometimes growing among other algae; sheaths colorless, more or less regularly cylindrical, not lamellose, in many species finally diffuent; trichomes many within the sheath in well developed filaments, closely crowded, often twisted into rope-like bundles; apex of trichome straight, tapering; apical cell acute, rarely obtuse conical, in one species capitate.

I. Plants living in salt water; apical cell not capitate, pointed.

1. Trichomes 1.5-2 mic. in diameter, constricted at joints

M. tenerrimus

2. Trichomes 2.5-6 mic. in diameter, constricted at joints

M. chthonoplastes

II. Plants living on soil; apical cell capitate.

M. vaginatus

III Plants living in fresh water; apical cell not capitate

- 1 Sheaths mucous, diffuent; trichomes 4-5 mic. in diameter, especially constricted at joints *M. lacustris*
- 2 Sheaths somewhat mucous, not or scarcely diffuent; trichomes 5-7 mic. in diameter, not constricted at joints *M. paludosus*
- 3 Plant mass large, cushion-like; trichomes 5-6 mic. in diameter *M. pulvinatus*
- 4 Sheaths very mucous and agglutinated; trichomes 6-10 mic. in diameter, especially constricted at joints *M. subtorulosus*

299. *Microcoleus tenerimus* Gomont. Monogr. Oscill. 93. pl. 14. f. 9-11. 1893. De Toni. Syll. Algar. 5: 373. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 30. 1865. Mazé and Schramm. Essai Class. Algues Guadeloupe. 20. 1870-1877. (*M. oligothrix* Crouan). Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 706. 1900. Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901; Notes on Algae.—VI. Rhodora. 5: 233. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 188. 1903.

Plate VI. fig. 27.

Filaments simple or slightly branched, densely entangled in a gray or blue-green mass, or mixed with various algae; sheaths wide, irregular in outline, pointed or open at the apex, sometimes entirely diffuent; trichomes 1.5-2 mic. in diameter, especially constricted at the joints, long, flexuous, usually loosely aggregated, more or less numerous within the sheath; apex of trichome often gradually tapering; apical cell not capitate, very acute conical; cells 2.2-6 mic. in length; transverse walls pellucid, sometimes granulated.

Maine. In rather small quantity. At Southwest Harbor, Mount Desert Island. (Holden). Louisiana. Forming a blue-green coating on an old wooden pier. Lake Pontchartrain. November 1898. (Saunders). Washington. In a salt marsh. Whidbey Island. (Gardner). West Indies. Brackish water. Guadeloupe. (Mazé). In company with *M. chthonoplastes*. March 1893. (Humphrey).

300. *Microcoleus chthonoplastes* (Flora danica) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 378. 1875. Gomont. Monogr. Oscill. 91. pl. 14. f. 5-8. 1893. De Toni. Syll. Algar. 5: 371. 1907.

Wolle. Fresh Water Algae. IV. Bull. Torr. Bot. Club. 7: 44. 1880. (*M. gracilis* Hass.). Farlow. Marine Algae of New England. 33. pl. 2. f. 3. 1881. Pike. Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. Wolle. Fresh-Water Algae U. S. 306. pl. 203. f. 10, 11. 1887. (*M. gracilis* Hass, *M. anguiformis* Harv). Bennett. Plants of Rhode Island. 115. 1888. Collins. Algae of Middlesex County. 14. 1888; Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. Martindale. Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 90. 1889. Wolle and Martin-

dale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (*Chthonoblastus lyngbei* Kg.). Johnson and Atwell. Fresh Water Algae. Northwestern University. Report Dept. Nat. Hist. 21. 1890. Collins. Algae. Rand and Redfield's Flora of Mount Desert Island. Maine. 247. 1894. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 4. no. 153. 1896. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora 2: 42. 1900. Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 19. no. 906. 1902. Collins. Notes on Algae. VI. Rhodora. 5: 233. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 188. 1903. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905. Tilden. American Algae. Cent. VII. Fasc. 1. no. 635. 1909.

Plate VI. fig. 28.

Filaments twisted, rarely branched, forming a dull or dark green, pan-nose, broadly expanded, compact, stratified mass, made up of layers of different colors, or growing sparsely among other algae; sheaths cylindrical, more or less unequal and roughened in outline, with apex usually open, sometimes entirely diffuent; trichomes 2.5-6 mic. in diameter, constricted at joints, short, somewhat straight, many within the sheath, usually densely aggregated into bundles, rarely twisted into cords; apex of trichome tapering; apical cell not capitate, acute conical; cells 3.6-10 mic. in length; transverse walls not granulated.

Canada. Mixed with other algae. Malpeque, Prince Edward Island. (Faull). Maine. Very common in lagoon. Little Cranberry Isle. (Collins). Shore west of Bracy Cove. (Holden). New Hampshire. (Collins). Massachusetts. Mixed with other algae, common along the New England coast. Wood's Holl. (Farlow). Salt marshes. (Collins). Growing on sand between tide marks, salt marsh. Wood's Hole. July 1895. (Osterhout). Rhode Island. Geneva. (Bennett). Connecticut. Forming a thick coating on turf near high water mark. Seaside Park; in sheets on sandy bottom between tide marks, Cook's Point, September, October. (Holden). New York. Shores of Long Island, Fort Hamilton, Greenport. Summer. (Pike). New Jersey. In brackish pools. Atlantic City. (Morse, Martindale). On moist earth. (Wolle). Texas. 1902. (Fanning). Ohio. Plankton. Put-in-Bay, Lake Erie. (Snow). Illinois. Running water. Big Woods, Cook County. April. (Johnson and Atwell). Dakota. (Hobby). Washington. Growing on the mud in a salt marsh. Pen's Cove, Whidbey Island. (Gardner). West Indies. In turfs of algae. St. Ann's Bay, Jamaica. March 1893. (Humphrey). Cuba. (R. de la Sagra).

301. *Microcoleus vaginatus* (Vaucher) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 353. 1890; Monogr. Oscill. 93. pl. 14. f. 12. 1893. De Toni. Syll. Algar. 5: 374. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*M. terrestris* Desmaz.); Fresh-Water Algae U. S. 305. pl. 203. f. 7-9; pl. 205. f. 16, 17. 1887. Collins. Algae of Middlesex County. 15. 1888. Bennett. Plants of Rhode Island. 115. 188. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 20. pl. 2. f. 21. 1894; The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 397. 1901. Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 189. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1011. 1903. Buchanan. Notes on the Algae of Iowa. Proc. Iowa. Acad. Sci. 14: 12. 1908.

Plate VI. fig. 29.

Filaments creeping, rarely entangled and twisted, sometimes branched; forming a black, glistening sheet; sheaths cylindrical, more or less unequal in outline, agglutinated, pointed and closed at the apex, or open and gradually disappearing, at times entirely diffuent; trichomes 3.5-7 mic. in diameter, not constricted at joints, many within the sheath, closely crowded, usually twisted into cords, the portion extruding from the sheath straight; apex of trichome gradually tapering and capitate; outer membrane of apical cell thickened into a depressed conical calyptra; cells 3-7 mic. in length; transverse walls frequently granulated.

Alaska. Forming, with other algae, a thin coating on damp ground, recently covered by snow. Glacier Bay. (Saunders). **Massachusetts.** Newton. (Farlow). Melrose. (Collins). **Rhode Island.** Common. (Bennett). **New Jersey.** On moist earth. (Wolle). **Iowa.** Damp ground. Grinnell. (Fink). On flower pots in greenhouse. Ames. (Buchanan). **Nebraska.** On damp earth in greenhouses. University. (Saunders). **Washington.** La Conner, Skagit County. (Gardner). **California.** In a gutter. Berkeley. February 1902. (Gardner). **West Indies.** On moist rock. Rio Cobre, Bog Walk, Jamaica. April 1893. (Humphrey).

302. *Microcoleus lacustris* (Rabenhorst) Farlow in Farlow, Anderson and Eaton. Algae. Am. Bor. Exsicc. no. 227. 1877. Gomont. Monogr. Oscill. 97. 1893. De Toni. Syll. Algar. 5: 376. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 307. 1897. Setchell. Notes on Cyanophyceae. III. Erythea. 7: 52. 1899. Riddle. Brush Lake Algae. Ohio Nat. 5: 268. 1905.

Filaments simple or vaguely branched, forked at the apex, twisted and entangled forming a black or blue-green layer; sheaths somewhat thin, mucous and agglutinated, sometimes diffuent, often gradually disappearing at the apex; trichomes 4-5 mic. in diameter, especially constricted at joints, somewhat parallel, the portion extruding from the sheath very straight; apical cell more or less obtuse conical, not capitate; cells 6-12 mic. in length; transverse walls not granulated; cell contents showing scattered coarse granules, pale blue-green.

Massachusetts. Newton. (Farlow). **Connecticut.** In tangled felty strata and disseminated among *Scytonema crispum*, in pool. North

Haven, November 1896. (Holden). **Pennsylvania.** "Distributed by Wolle under name of *Phormidium congestum* * * * probably collected in Pennsylvania."—Setchell. **Ohio.** Brush Lake, Champaign County. (Riddle).

303. *Microcoleus paludosus* (Kuetzing) Gomont. Monogr. Oscill. 96. pl. 14. f. 13. 1893. De Toni. Syll. Algar. 5: 376. 1907.

Setchell. Notes on Cyanophyceae. III. Erythea. 7: 53. 1899. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 13. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 17. no. 802. 1901. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 634. 1909.

Plate VI. fig. 30.

Filaments entangled, twisted, simple or forked at the apex, growing among other algae or forming a blackish or blue-green stratum; sheaths moderately mucous, open and disappearing at the apex or closed and pointed; trichomes 5-7 mic. in diameter, not constricted at joints, parallel, straight, or twisted into cords; apical cell not capitate; cells 4-13 mic. in length; transverse walls not granulated; cell contents light blue-green.

Rhode Island. (Osterhout). **Nebraska.** On wet soil in greenhouse. Lincoln. (Bessey). **California.** In southern part of the state. (Parish). In conservatory. Golden Gate Park, San Francisco. September 1900. (Gardner). In greenhouses. University of California, Berkeley. (Setchell). **Hawaii.** With other algae forming a layer covering rocks on bottom and sides of basin of "warm spring." Temperature at 7 a. m. $31^{\circ}+$ C. Puna, Island of Hawaii. July 1900. (Tilden).

304. *Microcoleus pulvinatus* Wolle. Fresh-Water Algae U. S. 305. pl. 204. f. 10-14. 1887. De Toni. Syll. Algar. 5: 379. 1907.

Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 609. 1889.

Plate VI. fig. 31.

Plant mass large, cushion-like, often 1.5 dm. in diameter, about 5 cm. in thickness, somewhat hollow in the center, dark olive brown, gelatinous-membranaceous; filaments 12-30 mic. in diameter; trichomes 5-6 mic. in diameter, one, two or three in a sheath.

New Jersey. "The thalli, of all possible sizes from one to ten inches in diameter, are attached to stones and grasses, looking like boulders in the bottom of a mill race with rapidly running water." Bamber. (Wolle).

305. *Microcoleus subtorulosus* (Kuetzing) Gomont. Essai Class. Nostocacées homocystées. Morot. Journ. de Bot. 4: 352. 1890; Monogr. Oscill. 98. pl. 14. f. 14, 15. 1893. De Toni. Syll. Algar. 5: 378. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. (Ph. subtorulosum Bréb.); Fresh-Water Algae U. S. 300. pl. 202. f. 3, 4. 1887. (Lyngbya subtorulosa (Bréb.) Wolle). **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 13. 1908.

Plate VI. fig. 32.

Plant mass lead-colored, spreading over aquatic plants and damp soil; filaments somewhat amorphous, fragile; sheaths very mucous, agglutinated; trichomes 6-10 mic. in diameter, especially constricted at joints, usually numerous within the sheath, parallel, straight; apex of trichome very gradually tapering; apical cell conical or cylindrical conical, not capitate; cells 5-10 mic. in length; cell contents showing scattered protoplasmic granules.

Florida. Moist ground. (Smith). Iowa. (Hobby).

Genus **CATAGNYMENE** Lemmermann.

Planktonalg. Ergebn. einer Reise n. d. Pacific. 354. 1899.

Filaments multicellular, floating free, surrounded by thin, close sheaths, enclosed in widely expanded, gelatinous diffuent envelopes, separating easily into fragments through the death of cells.

I Gelatinous envelope 93-100 mic. in diameter; trichomes up to 16 mic. in diameter, straight or curved. **C. pelagica**

II Gelatinous envelope 150-168 mic. in diameter; trichomes 20-22 mic. in diameter, spirally coiled **C. spiralis**

306. **Catagnymene pelagica** Lemmermann. Planktonalgen. Ergebnisse einer Reise nach dem Pacific. Abhandl. d. naturw. Verein in Bremen. 16: 354. pl. 3. f. 38-40, 42. 1899; Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 619. 1905. De Toni. Syll. Algar. 5: 381. 1907.

Outer envelope 93-100 mic. in diameter, gelatinous, colorless; trichomes up to 16 mic. in diameter, straight or curved; apical cell rotund or possessing a calyptra; cells very short, 3-4 mic. in length.

Hawaii. In plankton, between the islands of Laysan and Hawaii. 1896-97. (Schauinsland).

Var. **major** Wille. Die Schizophyceen der Plankton-Expedition. 51. pl. 1. f. 7. 1904. De Toni. Syll. Algar. 5: 382. 1907.

Plate VI. fig. 33.

Gelatinous envelope 100-165 mic. in diameter; trichomes 21-27 mic. in diameter.

Bermudas. Plankton. Atlantic Ocean. (Wille).

307. **Catagnymene spiralis** Lemmermann. Planktonalgen. Ergebnisse einer Reise nach dem Pacific. Abhandl. d. naturw. Verein in Bremen. 354. pl. 3. f. 41, 47-49. 1899; Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 619. 1905. De Toni. Syll. Algar. 5: 382. 1907.

Outer envelope 150-168 mic. in diameter, gelatinous, colorless; trichomes 20-22 mic. in diameter, spirally coiled; apical cell rotund; cells 3-4 mic. in length.

Hawaii. In plankton, between the islands of Laysan and Hawaii. 1896-97. (Schauinsland).

According to Wille, *Oscillatoria capitata* West should be made a variety of this species:

Var. *capitata* Wille. Die Schizophyceen der Plankton-Expedition. 52. pl. 1. f. 8, 9. 1904.

Plate VI. fig. 34.

Filaments irregularly wound or twisted within an oval gelatinous envelope; trichomes 10-14 mic. in diameter.

West Indies. Lat. 23° 44' N.; long. 45° 30' W. (Murray and Blackman).

Genus *HALIARACHNE* Lemmermann.

Planktonalg. Ergebn. einer Reise n. d. Pacific. 353. 1899.

Filaments multicellular, floating free, in somewhat globose or elongate, gelatinous colonies, arranged in two layers, radiating from the center, hooked at the apex; reproduction by division of the colony.

308. *Haliarachne lenticularis* Lemmermann. Planktonalgen. Ergebnisse einer Reise nach dem Pacific. Abhandl. d. naturw. Verein in Bremen. 353. pl. 2. f. 22-24. 1899; Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 619. 1905. De Toni. Syll. Algar. 5: 385. 1907.

Colony lenticular, 450-700 mic. in diameter; apical cell possessing a calyptra; cells about 8 mic. in diameter, 4-7 mic. in length; cell contents showing gas vacuoles.

Hawaii. In plankton, between the islands of Laysan and Hawaii. 1896-97. (Schauinsland).

Family II. NOSTOCACEAE

Sheaths forming a more or less distinct mucous, gelatinous or membranaceous tegument, mostly confluent, often not present; trichomes consisting of a single row of uniform cells, with heterocysts, usually twisting and entangled, not branched, showing no differentiation of base and apex, reproduction by means of vegetative division, hormogones and gonidia.

- I. Sheaths inconspicuous, or mucous and diffuent, or gelatinous, firm and thick
 - 1 Trichomes flexuous and contorted, forming a plant mass or colony of definite shape
 - (1) Colony usually of a rounded or expanded character, gelatinous, made up of dissolved individual sheaths, attached to the substratum or floating free in water; heterocysts intercalary
Nostoc
 - (2) Colony tubular, cylindrical; filaments somewhat straight, parallel, agglutinated
Wollea
 - 2 Trichomes more or less straight, free, or forming a thin mucous layer of indefinite shape

(1) Heterocysts and gonidia intercalary

- A Trichomes free; cells disc-shaped; shorter than their diameter; gonidia seriate, remote from the heterocysts

Nodularia

- B Trichomes naked, or with a thin mucous sheath, free or aggregated without order to form a flocculent mass; cells equal to or longer than their diameter; gonidia solitary, in pairs or in short series

Anabaena

- C Trichomes short, aggregated in parallel bundles to form thin, feathery, plate-like masses

Aphanizomenon

(2) Heterocysts terminal and the gonidia always contiguous to them

Cylindrospermum

II Sheaths thin, membranaceous, persistent; filaments free or agglutinated in a parallel manner

- 1 Sheaths not present; trichomes single, endophytic; heterocysts terminal

Richelia

- 2 Trichomes single within the sheath; heterocysts intercalary

Aulosira

- 3 Trichomes single within the sheath; heterocysts intercalary and terminal

Microchaete

- 4 Trichomes usually many within the sheath, forming a membranaceous or filamentous mass

Hormothamnion

Genus **NOSTOC** Vaucher. Hist. Conferves. 203. 1803.

Plant mass or colony at first globose or oblong, afterwards assuming various forms (globose, foliose, filiform, bullose) in the different species, solid or hollow, mucous, gelatinous or leathery, made up of tangled trichomes and their more or less dissolved sheaths; filaments flexuous, curved, entangled, coalesced; sheaths sometimes distinct, sometimes invisible; trichomes often torulose; cells depressed spherical, barrel-shaped or cylindrical; heterocysts intercalary and (in younger plants) terminal; gonidia spherical or oblong, developed centrifugally in series between the heterocysts.

- I Plants living in fresh water; forming minute, disc-shaped specks or patches on aquatic plants; plant mass growing at the periphery; filaments closely contorted.

N. cuticulare

- II Plants living in fresh water, microscopic, granular, aggregated, having the appearance of Aphanocapsa; filaments very closely entangled; trichomes scarcely distinct.

N. punctiforme

- III Plants living in fresh water, very minute; trichomes 2-3.5 mic. in diameter, distinct.

- 1 Plant mass very minute, punctiform; filaments loosely flexuous; trichomes 3-3.5 mic. in diameter; gonidia about 4 mic. in diameter, 6-8 mic. in length, oblong

N. paludosum

- 2 Plant mass small, adherent, somewhat globose; orange or green; trichomes 2-2.5 mic. in diameter, very short, strongly curved
N. aureum
- 3 Plant mass small, gelatinous, membranaceous, soft, green, blue-green or brownish; trichomes 3-4 mic. in diameter, flexuously curved, somewhat densely entangled
N. comminutum
- IV Plants living in fresh water; plant mass large, gelatinous, fragile, at first spherical, afterwards becoming torn and irregularly expanded.
 - 1 Filaments numerous, abruptly contorted, entangled; trichomes 3.5-4 mic. in diameter; gonidia 6-7 mic. in diameter, 7-8 mic. in length
N. linckia
 - 2 Filaments flexuous, loosely entangled
 - (1) Gonidia 6-7 mic. in diameter, spherical; wall of gonidium smooth; trichomes 4 mic. in diameter
N. piscinale
 - (2) Gonidia oblong; wall of gonidium smooth
 - A Trichomes 4-4.2 mic. in diameter; gonidia 6-8 mic. in diameter, 7-10 mic. in length, contiguous; wall of gonidium becoming brownish or colorless
N. rivulare
 - B Trichomes 3.5-4 mic. in diameter; gonidia 6 mic. in diameter, 8-10 mic. in length, not contiguous; wall of gonidium colorless
N. carneum
 - C Trichomes 4 mic. in diameter; cells different in shape, some cylindrical, others barrel-shaped or spherical depressed; gonidia 6-7 mic. in diameter, 10-12 mic. in length, not contiguous; wall of gonidium colorless or becoming yellowish
N. spongiaeforme
- V Plants living on soil; colonies gelatinous, soft, at first spherical, soon confluent and flattened, attached to soil or mosses
 - 1 Cells cylindrical; trichomes 4 mic. in diameter; gonidia 6-8 mic. in diameter
 - (1) Gonidia 14-19 mic. in length; wall of gonidium smooth
N. ellipsozporum
 - (2) Gonidia 8-14 mic. in length; wall of gonidium furnished with short spines
N. gelatinosum
 - 2 Cells oval, spherical or spherical depressed
 - (1) Trichomes 3-4 mic. in diameter; gonidia 4-8 mic. in diameter, 8-12 mic. in length, oblong, in a catenate series
N. muscorum
 - (2) Trichomes 2.2-3 mic. in diameter; gonidia 4 mic. in diameter, 6 mic. in length, oval
N. humifusum
- VI Plants living on soil, sometimes submerged; colonies free, at first spherical, then expanding symmetrically or irregularly; cells somewhat globose.
 - 1 Colonies gelatinous, spongy, lacunose, somewhat pellucid, green, olive or brownish; trichomes 4 mic. in diameter; gonidia 7 mic. in diame-

ter, 7-10 mic. in length, often oval; wall of gonidium smooth, colorless
N. foliaceum

- 2 Colonies expanded, irregular or orbicular, very thin, small, membranaceous, pellucid, blue-green; trichomes 4 mic. in diameter
N. punctatum

- 3 Colonies at first spherical, afterwards becoming flattened and finally spreading out into irregular, membranaceous sheets; surrounded by a firm outer layer; trichomes 4-5.6 mic. in diameter
N. commune

- ✓ 4 Colonies free, spherical, becoming irregularly plicate-tuberculate, thick, solid, surrounded by a firm outer layer; trichomes 4-5 mic. in diameter; gonidia 5 mic. in diameter, 7 mic. in length, oval; wall of gonidium thick, smooth, becoming brownish
N. sphaericum

- 5 Colonies spherical, finally becoming flattened, membranaceous; trichomes 2.5-3 mic. in diameter
N. minutum

- 6 Plants living in hot water; colonies indefinitely expanded, lacinate; filaments 2 mic. (?) in diameter
N. calidarium

- 7 Colonies somewhat spherical, small, very hard, sometimes soft, with surface often corrugated; trichomes 6.5-8.2 mic. in diameter
N. austinii

VII Plants living on soil or in fresh water; colonies spherical, surrounded by a firm outer layer.

1 Plants living on soil

- (1) Colonies small; trichomes 8-9 mic. in diameter; gonidia somewhat spherical, two or three times larger than the cells; wall of gonidium thin, very smooth
N. macrosporum

- (2) Colonies spherical or oblong, rarely beyond 1 cm. in diameter, somewhat pellucid; trichomes 5-8 mic. in diameter; gonidia 6-7 mic. in diameter, 9-15 mic. in length, oval
N. microscopicum

- (3) Colonies small or of medium size, spherical; trichomes 4-7 mic. in diameter; gonidia 6-7 mic. in diameter, exactly spherical; wall of gonidium somewhat thick, rough
N. sphaeroides

2 Plants living in fresh water

- (1) Colonies irregularly somewhat orbicular, gregarious and sometimes aggregated; trichomes 5 mic. in diameter
N. depressum

- (2) Colonies spherical, usually aggregated in grape-like clusters; trichomes 3.5-4 mic. in diameter
N. glomeratum

- (3) Colonies gregarious, pellucid, sky blue or blue-green; trichomes 5-7 mic. in diameter; cells barrel-shaped
N. caeruleum

- (4) Colonies spherical, surrounded by a leathery outer layer; trichomes 4-6 mic. in diameter
N. pruniforme

VIII Plants living in fresh water, attached; colonies somewhat spherical, bullate, rarely disc-shaped, surrounded by a firm outer layer; trichomes slender.

- 1 Trichomes 3-3.5 mic. in diameter, especially cylindrical; gonidia 5 mic. in diameter, 7 mic. in length; wall of gonidium smooth
N. verrucosum
 - 2 Trichomes 2-3 mic. in diameter, distinctly torulose; gonidia 3-4 mic. in diameter, 5-6 mic. in length; wall of gonidium smooth, brown
N. amplissimum
 - 3 Filaments radiating from the center, flexuous, very densely twisted and entangled near the surface; trichomes 4-4.5 mic. in diameter; gonidia 4-5 mic. in diameter, 7-8 mic. in length, oval; wall of gonidium smooth, yellowish
N. parmelioides
309. *Nostoc cuticulare* (Brébisson) Bornet and Flahault. Revision des Nostocacées hétérocystées contenues dans des principaux herbiers de France. Ann. Sci. Nat. Bot. VII. 7: 187. 1888. De Toni. Syll. Algar. 5: 387. 1907.
- Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 308. 1897.
- Plant mass flattened, adnate, forming thin, orbicular, confluent, dark blue-green patches; filaments closely entangled, here and there forming denser clusters; sheaths more or less distinct, wide, gelatinous, transparent; trichomes 3.8-4 mic. in diameter, torulose; cells barrel-shaped, equal to or a little longer than the diameter; heterocysts barrel-shaped, equal to or a little larger than the cells; cell contents blue-green.
- New York. On leaves of Potamogeton. Ithaca. (Atkinson).
310. *Nostoc punctiforme* (Kuetzing) Hariot. Le Genre Polycoccus Kuetzing. Morot. Journ. de Bot. 5: 29. 1891. Reinke. Zwei parasitische Algen. Bot. Zeit. 37: 473. pl. 6. f. 1-5. 1879. (*Anabaena cycadeorum* Reinke). Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 189. 1888. (*N. hederulae* Menegh.). Sauvageau. Sur le *Nostoc punctiforme*. Ann. Sci. Nat. Bot. VIII. 3: 367. pl. 17. 1897. Pampaloni. Il *Nostoc punctiforme* nei suoi rapporti coi Tubercoli Radicali delle Cicadee. Nuovo Giornale Bot. Ital. N. S. 8: 626. pl. 5. 1901. De Toni. Syll. Algar. 5: 388. 1907.
- Schneider. Mutualistic Symbiosis of Algae and Bacteria with *Cycas revoluta*. Bot. Gaz. 19: 25. pl. 3, 4. 1894. Tilden. American Algae. Cent. II. no. 171. 1896; List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 27. 1898. Life. The Tuber-like Rootlets of *Cycas revoluta*. Bot. Gaz. 31: 265. 1901. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 622. 1905. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 12. 1908.

Plate VI. fig. 35-37.

Colonies small, somewhat globose, scattered or confluent, adnate; filaments flexuous, very densely entangled; sheaths close, transparent, mucous; trichomes 3-4 mic. in diameter; cells depressed spherical or elliptical; heterocysts 4-6.5 mic. in diameter, transparent; gonidia somewhat spherical or oblong, 5-6 mic. in diameter, 5-8 mic. in length, with thick, smooth, outer membrane; cell contents finely granular, light olive green.

Minnesota. In roots of *Cycas revoluta*. University Plant House,

Minneapolis. December 1896. (Tilden). Iowa. In nodular thickenings on the roots of *Cycas revoluta*. Greenhouse. Ames. (Buchanan). Hawaii. "Sandwich Islands." 1896-97. (Schauinsland).

311. *Nostoc paludosum* Kuetzing. Tab. Phyc. 2: 1. pl. 1. f. 2. 1850. Janczewski. Observations sur la Reproduction de quelques Nostochinées. Ann. Sci. Nat. Bot. V. 19: 125. pl. 9. f. B. 1874. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 191. 1888. De Toni. Syll. Algar. 5: 390. 1907.

Plate VI. fig. 38.

Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 621. 1905.

Plant mass very minute, scarcely visible to the naked eye, punctiform, gelatinous; filaments loosely flexuous; sheaths wide, bullose; trichomes 3-3.5 mic. in diameter; cells barrel-shaped, equal in length to the diameter; heterocysts a little larger than the vegetative cells, light-colored; gonidia 4-4.5 mic. in diameter, 6-8 mic. in length, oval, blue-green, with a very thin, smooth, transparent outer membrane.

Hawaii. In ditches and pools between Honolulu and Waikiki, Oahu. 1896-97. (Schauinsland).

312. *Nostoc aureum* Kuetzing. Tab. Phyc. 2: 1. pl. 1. f. 4. 1850. De Toni. Syll. Algar. 5: 391. 1907.

Dickie. On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 9. 1880.

Colonies small, adherent, somewhat globose, orange or green, soft, somewhat elastic, mucous within; trichomes 2-2.5 mic. in diameter, very short, strongly curved, loosely entangled, sometimes nearly straight; cells sometimes crowded, sometimes separated, often continuous, somewhat globose or oblong, blue-green; heterocysts 3-4.5 mic. in diameter, spherical, single and scattered or in series.

Arctic Regions. Among mud from Floeberg, 82° 27' N. (Moss). "It must have been conveyed by currents from the land, or blown off shore with dust from a dried-up pool."—Dickie.

313. *Nostoc comminutum* Kuetzing. Tab. Phyc. 2: 3. pl. 10. f. 2. 1850. De Toni. Syll. Algar. 5: 393. 1908.

Wolle. Fresh-Water Algae U. S. 282. 1887. Harvey. The Fresh-Water Algae of Maine.—I. Bull. Torr. Bot. Club. 15: 161. 1888. Britton. Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889.

Plant mass small, gelatinous-membranaceous, soft, sometimes green or blue-green, sometimes becoming dull brownish; trichomes 3-4 mic. in diameter, flexuously curved, somewhat densely entangled; cells spherical or depressed spherical, strongly compressed, closely or loosely connected; heterocysts exactly spherical, up to twice the diameter of the cells, intercalary, rarely terminal; cell contents homogeneous, pale blue-green.

United States. Floating in ditches and smaller ponds. (Wolle). Maine. Abundant in a gathering made from a pool in the Penobscot at Great Works. (Merrill). New Jersey. On pond waters, frequent. (Wolle).

- ✓ 314. *Nostoc linckia* (Roth) Bornet in Bornet and Thuret. Notes Algologiques. 86. pl. 18. f. 1-12. 1880. Janczewski. Observations sur la Reproduction de quelques Nostochinées. Ann. Sci. Nat. Bot. V. 19: 127. pl. 9. f. C. 1874. (*N. minutissimum* Jancz.). Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 192. 1888. De Toni. Syll. Algar. 5: 391. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 5. 1878. (*N. intricatum* Menegh.). **Setchell.** Notes on Cyanophyceae.—I. Erythea. 4: 89. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 11. no. 507. 1898. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 189. 1903. **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 622. 1905.

Plate VII. fig. 1.

Colonies of various sizes, sometimes punctiform, expanded, at first globose, soon becoming enlarged and finally clathrate-fenestrate and irregularly torn, sometimes into filiform portions, gelatinous, blue-green or violet in color, or becoming darker; filaments numerous, abruptly twisted and flexuous; sheaths distinct near the surface of the mass, within confluent and transparent; trichomes 3.5-4 mic. in diameter, pale gray-green; cells short, depressed globose; heterocysts 5-6 mic. in diameter, somewhat spherical; gonidia 6-7 mic. in diameter, 7-8 mic. in length, somewhat globose, with a smooth outer membrane becoming darker with age.

Connecticut. Occurring in Lake Saltonstall, near New Haven. (Setchell). "It forms thickish sheets of a pale green color and very much crumpled. Occasionally some trace of its original globular shape is preserved and it forms large imperfect bladders several inches in diameter."—Setchell. **South Dakota.** In clear running spring water. Roberts County. (Saunders). "At first forming small, solid spherical masses, attached to stones, weeds, etc., finally becoming detached and forming hollow, torn, warty, dark brown masses, sometimes 10 cm. in diameter."—Collins, Holden and Setchell. **Nebraska.** In ponds. South Bend. (Bessey). **Washington.** Floating, intermingled with other algae, on ponds of fresh water. Near Coupeville, Whidbey Island. (Gardner). **Hawaii.** With *Conferva sandvicensis* and other algae in ponds. Paoa Valley, Oahu. 1875. (Berggren).

315. *Nostoc piscinale* Kuetzing. Phyc. Gen. 208. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 194. 1888. De Toni. Syll. Algar. 5: 393. 1907.

McClatchie. Proc. Southern Calif. Acad. 1: 346. 1897. (*N. rivulare*). **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 8. no. 355. 1897. **Richter.** Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. Heft. 42. 5. 1897. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 23. no. 1111. 1903. **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 622. 1905.

Plate VII. fig. 2.

Colonies at first globose, light blue-green, afterwards becoming bullose and variously tuberculate, mucous or gelatinous, dark blue-green; filaments flexuous, moderately entangled; sheaths distinct near the surface of the mass, dark-colored, those in the interior confluent, transparent; trichomes 4 mic. in diameter, pale olive green; cells depressed spherical or about twice as long as the diameter; heterocysts 4-5.6 mic. in diameter, somewhat spherical or oblong; gonidia 6-7 mic. in diameter, globose, in a long catenate series, approximate, with a smooth, transparent outer layer grown together with the sheath.

Greenland. Karajak. (Richter). **Canada.** Pool near Bow River, Lagan, Alberta. July 1901. (Butler and Polley). **California.** In stagnant pool. Near Pasadena. May 1896. (McClatchie). **Hawaii.** In ditches and pools between Honolulu and Waikiki, Oahu. 1896-97. (Schauinsland).

316. *Nostoc rivulare* Kuetzing. Tab. Phyc. 2: 3. pl. 10. f. 3. 1850. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 195. 1888. De Toni. Syll. Algar. 5: 395. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 189. 1903.

Colonies at first globose, of various sizes, soon becoming bullate, tuberculate, hollow, then irregularly torn and perforated, lobed, fragile, at first light green, when older becoming yellowish or of various colors; filaments loosely entangled, moderately flexuous; sheaths distinct, yellowish at the surface of the mass, those in the interior transparent and confluent; trichomes 4-4.2 mic. in diameter; cells spherical oblong, a little longer than the diameter; heterocysts 5-6 mic. in diameter, oblong; gonidia 6-8 mic. in diameter, 7-10 mic. in length, oblong or barrel-shaped, contiguous when mature, with smooth, transparent or dark-colored outer membrane.

Alaska. Forming floating masses of light brown jelly in springs and pools. Near Huntville, Unalaska. (Setchell and Lawson). **Washington.** Near Green Lake, Seattle. (Gardner).

317. *Nostoc carneum* Agardh. Syst. Algar. 22. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Bot. VII. 7: 196. 1888. De Toni. Syll. Algar. 5: 395. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 190. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 29. no. 1403. 1907.

Plate VII. fig. 3.

Colonies globose when young, later bullose, tuberculate, hollow, afterwards becoming irregular in form, expanded, diffuent into a gelatinous mucus, flesh-colored, dark-colored or pale blue-green; filaments loosely entangled, moderately flexuous; sheaths indistinct, transparent; trichomes 3.5-4 mic. in diameter; cells oblong cylindrical, about twice as long as wide; heterocysts 6 mic. in diameter, oblong; gonidia 6 mic. in diameter, 8-10

mic. in length, oval or elliptical, separated when mature, with a smooth, transparent thin outer membrane.

Alaska. Forming brown, floating masses of jelly on surface of streams. Glacier Valley, Unalaska. (Lawson). **Connecticut.** Floating in a spring, in irregularly rounded masses, from the size of a pin head to 5 cm. in diameter. Mount Carmel. October 1907. (Graves). **Washington.** Green Lake, Seattle. (Gardner).

318. *Nostoc spongiaeforme* Agardh. Syst. Algar. 22. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 197. 1888. De Toni. Syll. Algar. 5: 397. 1907.

Tilden. American Algae. Cent. I. no. 83. 1894; List of Fresh-water Algae collected in Minnesota during 1894. Minn. Bot. Stud. 1: 236. 1895. Richter. Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. 8: Heft. 42. A. 5. 1897. Tilden. Am. Alg. Century VI. no. 579. 1902. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1064. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 190. 1903. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 622. 1903. Tilden. American Algae. Cent. VII. Fasc. I. no. 633. 1909.

Plate VII. fig. 4, 5.

Colonies gelatinous, at first globose, afterwards expanded, verrucose, bullose, pale blue-green-violet, or reddish; filaments flexuous, loosely entangled; sheaths in the interior confluent, those near the outside of the mass more or less distinct, yellowish or dark-colored; trichomes about 4 mic. in diameter, blue-green or violet; cells different in shape, some cylindrical, up to 7 mic. in length, others barrel-shaped or depressed-spherical; heterocysts 7-8 mic. in diameter, somewhat globose or oblong; gonidia 6-7 mic. wide, 10-12 mic. long, oblong, separated; wall of gonidium smooth, later becoming dark-colored.

Greenland. Ikerasak. Very abundant. (Richter). **Minnesota.** Floating on surface of water in tank. State Fish Hatcheries, St. Paul. September 1894; on mosses and weeds in stagnant pond and on muddy ground, Woodland Park, Duluth. (Tilden). **Washington.** Floating in a small pool of fresh water. Edge of Green Lake, Seattle. (Gardner). **California.** Lake Chabot, San Leandro, Alameda county. June 1902. (Osterhout and Gardner). **Hawaii.** In bogs in Nuanu, Oahu. (Schauinsland).

319 A. *Nostoc ellipsosporum* (Desmazières) Rabenhorst. Fl. Eur. Algar. 2: 169. 1865. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 198. 1888. De Toni. Syll. Algar. 5: 398. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 29. 1865. (Hormosiphon antillarum S. and M.). Mazé and Schramm. Essai Class. Algues Guadeloupe. 14. 1870-1877. (L. antillarum Crouan). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 2. no. 59. 1895.

Plate VII. fig. 6-10.

Plant mass gelatinous, expanded, adhering by under surface, irregularly mammillary, reddish or dark-colored; filaments flexuous, laxly entangled; trichomes 4 mic. in diameter, pale blue-green or olive; cells

similar in form, cylindrical, 6-14 mic. in length; heterocysts somewhat spherical or oblong, 6-7 mic. wide, 6-14 mic. long; gonidia 6-8 mic. in diameter, 14-19 mic. long, elliptical or oblong-cylindrical; wall of gonidia smooth, transparent or yellowish.

Michigan. Growing over grass and moss, on wet clay bank, forming reddish-brown gelatinous masses, irregularly lobed and fusing into layers. Ann Arbor. September 1892. (Johnson). **Minnesota.** On wet rocks. Minnehaha Falls, Minneapolis. August 1883. (Farlow). **West Indies.** Guadeloupe. (Mazé).

- 319 B. *Nostoc gelatinosum* Schousboe in Bornet. Deuxième Note sur les Gonidies des Lichens. Ann. Sci. Nat. Bot. V. 19: 318. 1874. Bornet and Flahault. Revis. des Nostoc. VII. 7: 199. 1888. De Toni. Syll. Algar. 5: 399. 1905.

Plate VII. fig. 11.

Colonies more than a centimeter in diameter, gelatinous, irregularly expanded, bullate-tuberculate, brownish; filaments flexuous, loosely entangled; sheaths near the outside of colony distinct, those in the interior hyaline and confluent; trichomes 4 mic. in diameter; cells 5-10 mic. in length, oblong-cylindrical; heterocysts 5 mic. in diameter, 6-10 mic. in length, elliptical; gonidia 6-8 mic. in diameter, 8-14 mic. in length, with truncate apices, pale brownish in color; wall of gonidium furnished with minute spines.

Minnesota. With *Anthoceros* on bank of ditch. Near Minneapolis. September 1904. (Hillesheim).

320. *Nostoc muscorum* Agardh. Dispositio. Algar. Sueciae. 44. 1812. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 200. 1888. De Toni. Syll. Algar. 5: 400. 1907.

Dickie. In Hooker, J. D. An Account of the Plants collected by Dr. Walker in Greenland and Arctic America, etc. Journ. Linn. Soc. Bot. 5: 86. 1861; Notes on a collection of Algae procured in Cumberland Sound by Mr. James Taylor, etc. Journ. Linn. Soc. Bot. 9: 241. 1867. **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Wolle.** Fresh-Water Algae U. S. 282. pl. 197. f. 35. 1887. **Collins.** Algae of Middlesex County. 163. 1888. (Also *N. collinum*). **Anderson and Kelsey.** Common and conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 18. 1894. **Tilden.** American Algae. Cent. IV. no. 394. 1900. **West and West.** A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 288. 1898-1900. **Tilden.** American Algae. Cent. VI. no. 580. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 190. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 23. no. 1110. 1903. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904; Phycological Notes of the late Isaac Holden.—II. Rhodora 7: 242. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 25. no. 1211. 1905. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 11. 1908.

Plate VII. fig. 12-14.

Plant mass gelatinous-membranaceous, irregularly expanded, adhering by under surface, tuberculose, dull olive or dark-colored; filaments flexuous, densely entangled; trichomes 3-4 mic. in diameter, similar, olive; cells spherical or barrel-shaped, or cylindrical, about twice as long as broad; heterocysts somewhat globose, 6-7 mic. in diameter; gonidia 4-8 mic. in diameter, 8-12 mic. in length, oblong, in a catenate series, numerous; wall of gonidium smooth, yellowish.

Arctic Regions. Fresh water. Port Kennedy. (Lat. 72° N.) (Walker). **Alaska.** Near Iliuliuk, Unalaska. July 1899; forming soft gelatinous lumps and masses of various shapes, on rocks among mosses, Amaknak Cave, Amaknak Island, Bay of Unalaska. (Setchell and Lawson). **Canada.** Cumberland Sound, Davis Strait. (Taylor). In brown bunches on sides of rock among moss. Just above high tide. Baird Point. Minnesota Sea-side Station, Vancouver Island, British Columbia. August 1898. (Tilden). **Newfoundland.** Signal Hill, St. Johns. July 1897. (Holden). **Maine.** On sand by roadside, near seashore, in company with *Microcoleus vaginatus* Harpswell. July 1904. (Collins). **New Hampshire.** On mosses. Berlin Falls, near Shelburne. 1882, 1883. (Farlow). **Massachusetts.** Malden swamp in Middlesex Fells, Newton. (Farlow). **Minnesota.** On moist ground, among mosses and liverworts. St. Louis Park, Minneapolis. October 1901. (Hone). **Iowa.** On the stems of mosses. Fayette. 1905. (Fink). **Nebraska.** On wet rocks and on the moss covering them. (Saunders). **Montana.** Abundant on moss under dripping rocks. (Anderson and Kelsey). **Washington.** Moist ground just above high water. mark. Whidbey Island. (Gardner). **West Indies.** Growing on sides of road. Fort Charlotte, St. Vincent Island.

321. *Nostoc humifusum* Carmichael sec. Harvey in Hooker's British Flora. 2: 399. 1833. Bornet and Flahault, Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 201. 1888. De Toni. Syll. Algar. 5: 402. 1907.
- Wolle.** Fresh-Water Algae U. S. 280, 282. 1887. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 269. 1895; A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 288. 1898-1900.

Plate VII. fig. 15.

Plant mass gelatinous or mucous, irregular, of various sizes, sometimes punctiform, sometimes widely expanded from the confluence of many colonies, tuberculate, olive or brownish in color, adherent on under surface; filaments twisted and flexuous, densely entangled; sheaths usually yellowish and distinct throughout the mass, sometimes not distinct; trichomes 2.2-3 mic. in diameter; cells somewhat globose or twice as long as the diameter; heterocysts 3 mic. in diameter, somewhat spherical; gonidia 4 mic. in diameter, 6 mic. in length, somewhat globose or oval, with smooth and yellowish outer membrane; cell contents blue-green.

Florida. Colonies "inflated even to the size of a man's head." Island of Anastatia. (Smith). **West Indies.** On lime-trees. Shanford Estate; on trees, summit of Trois Pitons (4500 feet), November and December

1892; in stream, Wotten Waven, January and February 1896, Dominica. (Elliott).

322. *Nostoc foliaceum* Mougeot. Stirpes Vogeso-Rhenanae. Fasc. 14. no. 1372. 1854. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 202. 1888. De Toni. Syll. Algar. 5: 403. 1907.

Tilden. American Algae. Cent. V. no. 485. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 168. 1902.

Plate VII. fig. 16.

Plant mass gelatinous, spongy, lacunose, somewhat pellucid, green or olive, becoming brownish; filaments flexuous, entangled, pale blue-green; trichomes 4 mic. in diameter; cells spherical compressed; heterocysts 7 mic. in diameter, somewhat spherical; gonidia 7 mic. in diameter, 7-10 mic. in length, often oval; wall of gonidium smooth, colorless.

Hawaii. In globules among mosses and liverworts on dripping cliffs at side of road. South of Laupahoehoe, Hawaii. July 1900. (Tilden).

323. *Nostoc punctatum* Wood. Contr. Hist. Fresh-Water Algae North America. 32. 1874. De Toni. Syll. Algar. 5: 404. 1907.

Plant mass expanded, irregular or orbicular, very thin, small, membranaceous, pellucid, blue-green; filaments loosely interwoven, variously curved; cells 4 mic. in diameter, globose or often elliptical, mostly pellucid in the center, loosely connected; heterocysts 5 mic. in diameter, terminal or intercalary.

New Jersey. Damp Ground. September. (Austin).

324. *Nostoc commune* Vaucher. Histoire des Conferves d'eau douce. 222. pl. 16. f. 1. 1803. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 203. 1888. De Toni. Syll. Algar. 5: 404. 1907.

Harvey. Nereis Boreali Americana. Part III. 113, 114. Suppl. II. 134. 1858. (*N. verrucosum* Rabenh., *N. arcticum* Harv.). **Dickie.** Algae. Hooker. An Account of the Plants collected by Dr. Walker in Greenland and Arctic America during the Expedition of Sir Francis M'Clintock, R. N., in the Yacht "Fox." Journ. Linn. Soc. Bot. 5: 86. 1861; Notes on a Collection of Algae procured in Cumberland Sound by Mr. James Taylor, and Remarks on Arctic Species in General. Journ. Linn. Soc. Bot. 9: 240. 1867. **Wood.** Contr. Hist. Fresh-Water Algae North America. 32, 37. 1874. **Dickie.** On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. **Campbell.** Plants of the Detroit River. Bull. Torr. Bot. Club. 13: 93. 1886. **Wolle.** Fresh-Water Algae U. S. 283. pl. 197. f. 8. 1887. **Bennett.** Plants of Rhode Island. 114. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. **Wittrock and Nordstedt.** Algae Aq. Dulc. Exsicc. no. 890. 1890. **Anderson and Kelsey.** Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. **Smith and Pound.** Flora of the Sand Hill Region of

Sheridan and Cherry Counties. Bot. Surv. Nebraska. 30. 1893. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 17. 1894. **Nelson.** The Cryptogams of Wyoming. Wyoming Experiment Station. Tenth Ann. Report. 5. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 9. no. 403. 1898. **Trelease and Saunders.** Plants of Yakutat Bay. Harriman Alaska Expedition. no. 502. 1899. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3. 397. 1901. **Tilden.** American Algae. Cent. V. no. 486. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901; Cent. VI. no. 581. 1902; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 169. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 190. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 25. no. 1210. 1905. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 622. 1905. **Brown.** Algal Periodicity in Certain Ponds and Streams. Bull. Torr. Bot. Club 35: 247. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 11. 1908. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 31. no. 1504. 1908.

Plate VIII. fig. 1.

Plant mass gelatinous, firm, in the beginning spherical, afterwards becoming flattened, finally spreading out into undulating, folded, fleshy or membranaceous, entire or torn, often perforated sheets, leathery on the surface, blue-green, olive or brown in color; filaments flexuous, entangled; sheaths usually brownish near the surface of the mass, in the interior more or less distinct, often colorless; trichomes 4.5-6 mic. in diameter; cells depressed spherical or barrel-shaped; heterocysts 7 mic. in diameter, somewhat spherical, often up to three or five in number; gonidia not known.

Arctic Regions. In several localities and in various stages. From sea level up to 1000 feet. Prevoost Island; shores of Hayes Sound; Floeberg Beach; Egerton Valley. (Dickie). On naked soil in boggy ground. Assistance Bay, Lat. 75° 40' N. (Sutherland). Beechey Island. (Lyall). Fresh water. Port Kennedy. (Walker). **Alaska.** Forming thin leathery thalli of indefinite size and shape, on damp ground. Near Glacier Bay. (Saunders). Hidden Glacier, Yakutat Bay. June 1899. (Trelease). Assuming various shapes, from discoid thalli to flat expansions of considerable extent, on soil or on rocks. St. Michael. (Setchell). Iliuliuk, Unalaska. (Setchell and Lawson). **Greenland.** On stones in fresh water stream and pools of fresh water. Disko Island. (Lyall). **Canada.** Various parts of the shores of the Gulf, Cumberland Sound, Davis Strait. (Taylor). **Massachusetts.** On steep wet rock near Winchester North Reservoir. June 1904. (Collins). **Rhode Island.** Common. (Bennett). **Connecticut.** On limestone. Road near Gaylordsville. October. (Holden). **New Jersey.** On wet ground, common. (Austin). Dripping rocks, Palisades, Bergen. (Wolle). **Maryland.** On a grassy bank in sandy soil. Loch Raven, Baltimore county. July 1897. (Waters). **Georgia.** On moist ground among various plants. Thomson, McDuffee County. August 1908. (Bartlett). **Texas.** On mud

flats. Cedar Bayou, Harris County. (Ravenel). **Indiana.** Near Bloomington. (Brown). **Michigan.** Grosse Isle, near mouth of Detroit River. Summer of 1885. (Campbell). **Minnesota.** On damp ground on hillside. Mendota. October 1901. (Hillesheim and Lilley). **Iowa.** A very common alga in the damp margins of marshy places. Iowa City. 1880. (Hobby). Ames. (Bessey, Buchanan). Grinnell. 1904. (Fink). Eagle Grove. 1904. (Buchanan). **Nebraska.** On the ground and in shallow ponds in a pass between two wet valleys. Cherry County. July 1892. (Smith and Pound). Frequent on damp earth and in stagnant or running water. Often found covering the ground for some distance in damp places. (Saunders). **Kansas.** Attached to bare patches of soil. (Parry). **Montana.** "Common throughout the state. On the high foot-hills (5,000-7,000 feet), on the alkaline plains and in the valleys. In inundated places, where the water is kept warm by the sun's rays, this *Nostoc* grows with marvelous rapidity, and frequently attains a diameter of ten inches and a half in thickness." (Anderson and Kelsey). **Wyoming.** Very plentiful in small pools on ledges of rock. Telephone Cañon, Albany County. April 1897. (Nelson). **New Mexico.** Santa Fé. (Fendler). **Washington.** Whidbey Island. (Gardner). **Mexico.** On damp soil in autumn; common after rain on dry flats. Rio Bravo (Rio Grande). (Schott). **Bermudas.** On the ground. Castle Point. February 1898. (Richards). **West Indies.** In crusts on sandy soil. Constant Spring, Jamaica. April 1893. (Humphrey). **Hawaii.** In dense forest. Near Halfway House, Kilauea, Hawaii. (Schauinsland). Forming gelatinous, firm, flat wrinkled masses on boards of flume (not covered by water), head of flume. (2,300 feet). Pacific Sugar Mill, Hamakua, Hawaii. July 1900. (Tilden).

Var. *flagelliforme* (Berkeley and Curtis) Bornet and Flahault. l. c. 206. Wright. *Plantae Texanae*. no. 3809. Harvey. l. c. 115. Wood. l. c. 226. De Toni. l. c. 408.

Farlow, Anderson and Eaton. *Algae Am.-Bor.* Exsicc. no. 100. 1878. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. Collins, Holden and Setchell. *Phyc. Bor.-Am.* Fasc. 31. no. 1505. 1908.

Plant mass filiform, up to 3-4 mm. in width, firm; trichomes parallel.

Texas. On naked aluminous soil. San Pedro. (Wright). **Montana.** Very common on the alkali plains about Helena. It has the appearance of "small weather-beaten, entangled tufts of black horsehair." (Anderson and Kelsey). **Mexico.** On sandy soil. Mazapil, Zacatecas. (Lloyd).

325. *Nostoc sphaericum* Vaucher. *Histoire des Conerves d'eau douce*. 223. pl. 16. f. 2. 1803. Bornet and Flahault. *Revis. des Nostoc*. Ann. Sci. Nat. Bot. VII. 7: 208. 1888. De Toni. *Syll. Algar.* 5: 409. 1907.

Wood. *Contr. Hist. Fresh-Water Algae North America*. 30. 1872. Campbell. *Plants of the Detroit River*. Bull. Torr. Bot. Club. 13: 93. 1886. Wolle. *Fresh-Water Algae U. S.* 283. pl. 197. f. 18-20. 1887. Collins. *Algae of Middlesex County*. 14. 1888. Bennett. *Plants of Rhode Island*. 114. 1888. Wolle and Martindale. *Algae*. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club.

18: 144. 1891. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 269. 1895. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. **Tilden.** American Algae. Cent. III. no. 291. 1898. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 16. no. 755. 1900. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **Tilden.** American Algae. Cent. VI. no. 582. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 30. no. 1453. 1908. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 11. 1908.

Plate VIII. fig. 2.

Colonies free, spherical 1-15 mm. in diameter, finally becoming irregularly plicate-tuberculate, thick, sometimes 6-7 cm. in diameter, solid, surrounded by a firm outer layer, olive green, yellowish or violet, becoming brownish; filaments flexuous, densely entangled; trichomes 4 rarely 5 mic. in diameter; cells spherical compressed or barrel-shaped; heterocysts 6 mic. in diameter, somewhat spherical; gonidia 5 mic. in diameter, 7 mic. in length, oval; wall of gonidium thick, smooth, becoming brownish.

Alaska. On dripping rocks among mosses. Amaknak Island, Bay of Unalaska. (Setchell and Lawson). **Maine.** Minute colonies free, among various algae, in salt marsh pools. Harpswell. July 1905. (Collins). **Massachusetts.** In minute blackish or greenish rounded masses on wet rocks, near the Cascade. Melrose, Middlesex Fells. (Collins). **Rhode Island.** Providence. (Bennett). **New Jersey.** Abundant on wet rocks. (Wolle). **Pennsylvania.** Adhering to mosses and twigs in the water. Spring Mills, near Philadelphia. (Wood). **North Carolina.** On wet rocks with moss. Tryon. March 1897. (Green). **Michigan.** Grosse Isle. Near mouth of the Detroit River. Summer of 1885. (Campbell). **Minnesota.** Among mosses on cliff overhanging stream. Dalles of the St. Louis River, Fond du Lac, near Duluth. August 1901. (Tilden). **Iowa.** Iowa City. (Hobby). Ames. (Bessey). **Nebraska.** On soil in greenhouse. Lincoln. (Bessey). **Montana.** Damp rocks in shady ravines. (Anderson and Kelsey). **West Indies.** On damp wall of dam in Sharp's River, St. Vincent. May 1892. (Elliott).

326. **Nostoc minutum** Desmazières. Plantes Cryptog. de France. 1st Ed. Fasc. 11. no. 50. 1831. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 209. 1888. De Toni. Syll. Algar. 5: 411. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903.

Plant mass minute, gregarious, spherical, finally becoming flattened, membranaceous, up to 10 mm. in diameter; filaments densely entangled; trichomes 2.5-3 mic. in diameter; cells barrel-shaped; heterocysts 4-5 mic. in diameter; gonidia unknown.

Alaska. On dripping rocks, much mixed with other algae of a gelatinous nature. Iliuliuk, Unalaska. (Setchell and Lawson).

327. *Nostoc calidarium* Wood. Contr. Hist. Fresh-Water Algae North America. 34. pl. 2. f. 2. 1872. De Toni. Syll. Algar. 5: 409, 423. 1907.

Plate VIII. fig. 3.

Plant mass indefinitely expanded, either membranaceous coriaceous or gelatinous, bright or dull olive green or olive brown, irregularly and deeply sinuate, finally neatly lacinate; filaments 2 mic. (?) in diameter, unequal, sometimes flexuously curved but mostly straight and closely joined, occurring in two forms; the one small, with cylindrical cells, scattered heterocysts and diffuent sheaths, if any; the other form very large, with globose or oblong cells and heterocysts not different from the other cells.

California. In hot springs. Temperature 110-120° and 124-135°. F. Benton's Spring, Owen's Valley, sixty miles southwest from Aurora. (Partz).

328. *Nostoc austinii* Wood. Contr. Hist. Fresh-Water Algae North America. 27. 1872. De Toni. Syll. Algar. 5: 411. 1907.

Colonies somewhat spherical, small, mostly the size of fish eggs, but reaching the diameter of nearly 4 mm., sometimes very hard, sometimes much softer, with surface often corrugated, brownish or blackish; filaments variously curved, densely entangled or distantly and loosely interwoven, greenish, brownish, lead-colored or yellowish brown; sheaths often distinct in smaller colonies, those in larger ones indistinct or not visible; trichomes 6.5-8.2 mic. in diameter; cells spherical, often in pairs; heterocysts equal to diameter of cells or a little larger, spherical, intercalary or terminal, cell contents coarsely granular.

New Jersey. Growing amidst mosses on rocks. Near Gloucester. (Austin).

329. *Nostoc macrosporum* Meneghini. Monographia Nostochinearum ital. 116. pl. 14. f. 2. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 209. 1888. De Toni. Syll. Algar. 5: 412. 1907.

Farlow. Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Wolle.** Fresh-Water Algae U. S. 284. 1887. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901.

Plate VIII. fig. 4.

Colonies small, solid, spherical or oblong, blue-green or olive, becoming brownish; filaments loosely entangled, flexuously curved, or spirally rolled; sheaths often distinct, yellowish; trichomes 8-9 mic. in diameter, especially cylindrical; cells short, disc-shaped, or equalling the diameter in length, closely connected; heterocysts 9-10 mic. in diameter, somewhat spherical; gonidia (according to Borzi) "globose, angular from mutual pressure, or globose-compressed, two or three times larger than the cells; wall of gonidium thin, very smooth"; cell contents pale blue-green or olive green.

New Hampshire. Mixed with other algae. The "Flume," Shelburne, Lake Willoughby. (Farlow). **Nebraska.** On pots in greenhouse. Lincoln. (Bessey).

330. *Nostoc microscopicum* Carmichael. Harvey in Hooker's British Flora. 5: 399. 1833. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 210. 1888. De Toni. Syll. Algar. 5: 413. 1907.

. Harvey. Nereis Boreali-Americana. Part III. 115. 1858. Dickie. Notes on a Collection of Algae procured in Cumberland Sound by Mr. James Taylor. Journ. Linn. Soc. Bot. 9: 241. 1867. Farlow. Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. (N. rupestre Kg.). Harvey. The Fresh-Water Algae of Maine. I. Bull. Torr. Bot. Club. 15: 161. 1888. Bennett. Plants of Rhode Island. 114. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 6. no. 256. 1897. Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1109. 1903. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903. Collins. Algae of the Flume. Rhodora. 6: 230. 1904. West. West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate VIII. fig. 5.

Colonies spherical or oblong, rarely beyond 1 cm. in diameter, soft, at first glistening, finally becoming olive or brownish; filaments loosely entangled; sheaths more or less distinct, yellowish, "contrasting with the generally uncolored jelly" (Cooke); trichomes 5-8 mic. in diameter; cells somewhat spherical; heterocysts 7 mic. in diameter, somewhat spherical; gonidia 6-7 mic. in diameter, 9-15 mic. in length, oval, olive; wall of gonidium smooth; cell contents sky blue or violet-green.

Canada. On stones in a small stream. Baffin's Bay. (Sutherland). Cumberland Sound. (Taylor). **Maine.** In a lake near Houlton. (Harvey). **New Hampshire.** On rocks. The "Flume." (Farlow). **Vermont.** On wet rocks. Ripton Gorge. September 1896. (Farlow). **Massachusetts.** On pebbles in rather shallow water. Suntaug Lake, Peabody. September 1892. (Collins). **Rhode Island.** Providence. (Bennett). **Connecticut.** Sage's Ravine, Salisbury, below First Falls. October. (Holden). **New Jersey.** Frequent on moist rocks. (Wolle). **Washington.** Floating, intermingled with other algae. Whidbey Island; Seattle. (Gardner). **West Indies.** On steps into reservoir. Constant Spring. April 1893. (Humphrey). "Chancery Lane Estate," Barbados. (Howard).

331. *Nostoc sphaeroides* Kuetzing. Tab. Phyc. 2: 2. pl. 4. f. 1. 1850. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII 7: 212. 1888. De Toni. Syll. Algar. 5: 415. 1907.

Hall. List of the Marine Algae growing in Long Island Sound within 20 miles of New Haven. Bull. Torr. Bot. Club. 6: 112. 1876. Collins. Algae of Middlesex County. 14. 1888. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 10. no. 454. 1898. Saunders. The Algae. Harriman Alaska

Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903.

Colonies of medium size, spherical, green becoming bluish; trichomes 4-7 mic. in diameter, tapering at the apices; gonidia 6-7 mic. in diameter, exactly spherical, angular from mutual pressure, orange becoming brownish; wall of gonidium somewhat thick, rough.

Alaska. Forming a soft, bluish green coating on rocks near Juneau. (Saunders). **Massachusetts.** Cambridge. (Farlow). Fresh Pond, Cambridge. (Richards). **Connecticut.** Pools. Whitneyville and Beaver Meadows. (Eaton).

332. *Nostoc depressum* Wood. Contr. Hist. Fresh-Water Algae North America. 30: 1872. De Toni. Syll. Algar. 5: 415. 1907.

Colonies irregularly suborbicular, gregarious and sometimes aggregated, elastic, surrounded by a firm, translucent outer layer, about the size of a mustard seed or smaller, adhering to submerged mosses, blackish in color; filaments mostly loosely interwoven; sheaths not present; trichomes 5 mic. in diameter; cells spherical, generally rather closely connected, rarely distant; heterocysts, 7 mic. in diameter, rather larger than the cells.

New Jersey. Attached to a brook moss, growing in a rapid rivulet in the northern part of the state. (Austin).

333. *Nostoc glomeratum* Kuetzing. Tab. Phyc. 2: 2. pl. 3. f. 5. 1850. De Toni. Syll. Algar. 5: 415. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877.

Plate VIII. fig. 6, 7.

Colonies spherical, usually aggregated in grape-like clusters, lead-colored or becoming somewhat purplish, with inconspicuous outer layer; trichomes 3.5-4 mic. in diameter, more or less densely entangled, somewhat equal in thickness; cells spherical, crowded; heterocysts 7-7.7 mic. in diameter.

California. On filaments of old *Cladophora*. (Anderson).

334. *Nostoc caeruleum* Lyngbye. Hydrophytologia danica. 201. pl. 68. f. B. 1819. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 213. 1888. De Toni. Syll. Algar. 5: 416. 1907.

Wood. Contr. Hist. Freshwater Algae. North America. 31. 1872. **Wolle.** Fresh-Water Algae U. S. 284. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. **Tilden.** American Algae. Cent. I. no. 84. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 24. no. 1166. 1904. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 11. 1908.

Plate VIII. fig. 8.

Colonies very small, up to 5-6 mm. in diameter, spherical, solid,

separate or aggregated, sometimes proliferated, surrounded by a firm, tenacious outer layer, blue-green, sky blue, or becoming brownish, pellucid; filaments densely interwoven, flexuously twisted; sheaths usually indistinct; trichomes 5-7 mic. in diameter, twisted; cells barrel-shaped; heterocysts 8-10 mic. in diameter, spherical or depressed spherical; gonidia unknown.

New Jersey. Growing attached to moss. Northern part of state. (Austin). **Minnesota.** In small stagnant pools at edge of lake. Parker's Lake, Hennepin County. July 1894. (Tilden). Floating in great quantities. Lake Zumbra. September 1903. (Butler). **Iowa.** Ames. 1884. (Bessey). **Washington.** In a ditch of fresh water. Near Seattle. (Gardner).

335. *Nostoc pruniforme* (Linn.) Agardh. Dispositio Algar. Sueciae. 45. 1812. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 215. 1888. De Toni. Syll. Algar. 5: 418. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 28. 1872. **Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. **Rabenhorst.** Die Algen Europas. no. 2530. 1878. **Twitchell.** Remarks on a Variety of *Nostoc pruniforme*. Journ. Cin. Soc. Nat. Hist. 9: 253. 1886. **Wolle.** Fresh-Water Algae U. S. 284. 1887. **Atwell.** A Deep-Water *Nostoc*. Bot. Gaz. 14: 291. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. **Johnson and Atwell.** Fresh Water Algae. Northwestern University. Report Dept. Nat. Hist. 21. 1890. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 18. pl. 1. f. 4. a, b. 1894. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894; American Algae. Cent. I. no. 85. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 2. no. 58. 1895; l. c. Fasc. 14. no. 657. 1900. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903. **Collins.** Phycological Notes of the late Isaac Holden. II. 7: 237. 1905. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 11. 1908.

Plate VIII. fig. 9, 10.

Colonies spherical, attaining the size of a hen's egg, soft and watery within, at length hollow, surrounded by a leathery outer layer, olive or dark blue-green, finally becoming brownish or blackish; filaments loosely entangled, radiating from the center; sheaths often distinct, colorless, rarely yellowish; trichomes 4-6 mic. in diameter, cells spherical compressed or a little longer than the diameter; heterocysts 6-7 mic. in diameter, somewhat spherical.

Maine. (Leidy). **Connecticut.** In a stagnant pool connected with the lower of "Twin Lakes," mostly resting on the bottom, but attached when young to sticks, etc., growing to the diameter of about 5 cm. Salisbury, Litchfield County. August 1895. (Holden). **New Jersey.** In ponds, frequent. (Wolle). **Pennsylvania.** In stagnant water. Bethlehem. 1877. (Wolle). **Illinois.** "With the first gales of November and March each year there appears upon the shore of Lake Michigan, an abundance of

an interesting form of *Nostoc*. It was first observed in 1864 by Professor Oliver Marcy. Thrown out upon the shore by the waves, it appears as small, purple and green balls or thalli." (Atwell). Thrown up in extensive "windrows" on the shore of Lake Michigan. Evanston. August 1894. (Johnson). **Minnesota**. Lake Kilpatrick. June 1893; floating free or attached to water plants in artificial lake, Minneapolis, August 1894. (Tilden). **Iowa**. Nodules often reaching the size of a plum. (Fink). Very small, in pool near Ontario, Ames. (Buchanan). **Nebraska**. In still water. (Saunders). **Idaho**. (Twitchell). **Washington**. In ditches of fresh water. Near Seattle. (Gardner).

336. *Nostoc verrucosum* (Linn.) Vaucher. Histoire des Conferves d'eau douce. 225. pl. 16. f. 3. 1803. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 216. 1888. De Toni. Syll. Algae. 5: 419. 1907.

Harvey. Nereis Boreali-Americana. Part III. 114. 1858. **Dickie**. Algae. Hooker. An Account of the Plants collected by Dr. Walker in Greenland and Arctic America during the expedition of Sir Francis M'Clintock, R. N., in the Yacht "Fox," 21 Je. 1860. Journ. Linn. Soc. Bot. 5: 79. 1861; Notes on a Collection of Algae procured in Cumberland Sound by Mr. James Taylor. l. c. 9: 241. 1867. **Harvey**. Determinations of Algae in Rothrock's Sketch of the Flora of Alaska. Ann. Rept. Bd. Regents. Smiths. Inst. for 1867. **Wood**. Contr. Hist. Fresh-Water Algae North America. 28. 1874. **Wolle**. Fresh-Water Algae. U. S. 284. pl. 197. f. 1, 2. 1887. **Johnson and Atwell**. Fresh Water Algae. Northwestern University. Report. Dept. Nat. Hist. 21. 1890. **Anderson and Kelsey**. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. **Millspaugh**. Contribution III. to the Coastal and Plain Flora of Yucatan. Field Columbian Museum. Bot. 1: 347. 1898. **Tilden**. American Algae. Cent. V. no. 393. 1900. **Bessey, Pound and Clements**. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **Collins**. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Tilden**. Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 487. 1901; Cent. VI. no. 583. 1902; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 170. 1902. **Setchell and Gardner**. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903. **Brown**. Algal Periodicity in Certain Ponds and Streams. Bull. Torr. Bot. Club. 35: 242, 247. 1908.

Plate VIII. fig. 11-16.

Colonies often gregarious, up to 10 cm. in diameter, at first solid, gelatinous, firm, spherical or rotund and plicate-undulate, afterwards becoming hollow, vesicular, softer, and torn, when young olive-blackish, becoming brownish green when older; filaments flexuously twisted, densely entangled near the surface; sheaths thick, often indistinct, colorless or yellowish brown; trichomes 3-3.5 mic. in diameter, especially cylindrical; cells spherical depressed, shorter than the diameter; closely connected; heterocysts 6 mic. in diameter, somewhat spherical; gonidia 5 mic. in diameter, 7 mic. in length; oval; wall of gonidium smooth, yellowish.

Arctic Regions. Beechey Island. (Lyall). Port Kenedy. (Walker). **Alaska.** Fresh water pools. Port Clarence. (Harvey). **Greenland.** On stones in fresh water streams; in pools of fresh water, Island of Disko. (Lyall). **Canada.** Freshwater. Cumberland Sound. (Taylor). **Pennsylvania.** Growing in great abundance in very cold, large, limestone spring. Centre County. Summer of 1869. (Wood). **Indiana.** Attached to the stone bottom of a small stream, flowing across University Campus. Jordan Branch. Bloomington. (Brown). **Wisconsin.** Attached to rocks in waterfall. Burkhardt. September 1899. (Tilden). **Illinois.** Bowmanville. July. (Johnson and Atwell). **Minnesota.** On rocks in falls in river. Lester River, Lester Park, Duluth. August 1901. (Tilden). **Nebraska.** In culture in greenhouse. Lincoln. (Bessey). **Montana.** "Common at the Falls of the Missouri and in spring water impregnated with lime. In the fall of the year this species is torn from its hold on submerged rocks in the upper Missouri River, rises to the surface and floats to the shore in large numbers. Sometimes watery, hollow specimens, the size of bantam eggs, are picked up." (Anderson and Kelsey). **New Mexico.** Santa Fé. (Fendler). **Nevada.** Attached to rocks in running water. Humboldt River, Winnemucca. July 1901. (Griffiths). **Mexico.** "Found in the aguada Chulubmay, nine miles east of Izamal. March." (Millspaugh). **West Indies.** On rocks in "Wag Water" and in a trough in running water. Castleton, Jamaica. April 1893. (Humphrey). **Hawaii.** Forming small, black, "shot-like" balls, covering sides of pools in falls and rapids. Head waters of flume (2,300 feet), Pacific Sugar Mill, Hamakua, Hawaii. July 1900. (Tilden).

337. *Nostoc amplissimum* Setchell. Notes on Cyanophyceae. III. Erythraea. 7: 50. pl. 2, 3. f. 1, 2. 1899. De Toni. Syll. Algar. 5: 421. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 558. 1899.

Plate VIII. fig. 17-19.

Colonies at first spherical, very early becoming hollow and lobulated, expanding until they become irregular, verrucose, brownish yellow sacs, measuring up to 60 x 30 cm.; membrane of sack of varying thickness, 2-10 mm., composed of one to several layers of jelly in which trichomes are embedded, also containing abundant small lumps of lime; filaments very numerous, arranged somewhat variously, near upper and lower surfaces much contorted, in middle more nearly horizontal and parallel; sheaths of outer filaments conspicuous, wide, brown, those of inner filaments distinct, colorless, usually wanting in case of central filaments; trichomes 2-3 mic. in diameter, more or less torulose; cells 3.5-5 mic. in length, depressed spherical or short cylindrical; heterocysts usually about 4 mic. in diameter; gonidia 3-4 mic. in diameter, 5-6 mic. in length, ellipsoidal, usually beginning to form in outer layer, wall of gonidium smooth, brown.

California. On stones in streams. Near Pasadena. May 1896. (McClatchie). Floating and attached to the sides of a watering-trough, supplied from an artesian well. Near Hollister. April 1897. (Setchell).

Dr. Setchell calls attention to the fact that this is the largest species belonging to the Cyanophyceae.

338. *Nostoc parmelioides* Kuetzing. Phyc. Gen. 206. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 219. 1888. De Toni. Syll. Algar. 5: 422. 1907.

Harvey. Nereis Boreali-Americana. Part III. 114, 134. 1858. (*N. cristatum* Bailey, *N. sutherlandi* Dickie). Schramm and Mazé. Essai Class. Algues Guadeloupe. 29. 1865. (*Hydrococcus guadelupensis* Crouan). Mazé and Schramm. Essai Class. Algues Guadeloupe. 13. 1870-1877. (*Oncobyrsa guadelupensis* Crouan). Wood. Contr. Hist. Fresh-Water Algae North America. 29. 1872. *N. alpinum* Wood). Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877; Fresh-Water Algae U. S. 285. pl. 197. f. 33, 34. 1887. Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 428. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 2. no. 57. 1895. Tilden. American Algae. Cent. II. no. 168. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 236. 1896. Tilden. American Algae. Cent. VI. no. 584. 1902.

Plate VIII. fig. 20.

Colonies attached, disc-shaped or tongue-shaped, hard, sometimes somewhat spherical, of various sizes, up to 2 cm. in diameter; filaments radiating from the center, somewhat straight at the center, parallel, entangled, those near the surface densely twisted and entangled; sheaths of outer filaments yellowish, distinct, those of the inner, colorless, often confluent; trichomes 4-4.5 mic. in diameter; cells spherical or spherical depressed, closely connected; heterocysts 6 mic. in diameter, somewhat spherical; gonidia 4-5 mic. in diameter, 7-8 mic. in length, oval; wall of gonidium smooth, yellowish.

Canada. South side of harbor in winter quarters. Baffin's Bay. July 1851. (Sutherland). Connecticut. Attached at one point to smooth sandstone bed of a mountain rivulet. Mt. Carmel. September 1893. (Setchell). Goshen. August 1895. (Green). New York. In mountain rivulets, attached to stones under water. Near West Point. (Bailey). Crumelbow Creek, Hyde Park, New York City. (Harvey). Palisades. (Wolle). Pennsylvania. Abundant on stones on rocky bottom of river. Susquehanna River, at Harrisburgh. (Wolle). Near Harrisburgh. (Kelley). Wyoming. Attached to granitic rocks in creek about four miles from the melting snow which feeds the creek. (9,000 feet). North Fork, Clear Creek, Big Horn Mountains. August 1898. (Williams and Griffiths). Nevada. In cold streams. Clover Mountains. (11,000 feet). (Watson).

Genus **WOLLEA** Bornet and Flahault. Revis. des Nostoc. 223. 1888.

Plant mass or colony tubular, cylindrical, somewhat membranaceous, soft; filaments somewhat straight, parallel or slightly curved, agglutinated; sheaths confluent; heterocysts intercalary; gonidia catenate, contiguous to the heterocysts or remote from them.

339. *Wollea saccata* (Wolle) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 223. 1888. Wolle. Fresh Water Algae. IV.

Bull. Torr. Bot. Club. 7: 44. 1880. (*Sphaerozyga saccata* Wolle). Wittrock and Nordstedt. Algae Aq. Dulc. Exsicc. no. 397. 1880. Wolle. Fresh-Water Algae N. S. 290. pl. 199. f. 1. 1887. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. De Toni. Syll. Algar. 5: 432. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 1. no. 30. 1895.

Plate VIII. fig. 21, 22.

Colonies 2-6 mm. in diameter, up to 1 dm. in length, consisting of elongated, vertical, somewhat membranaceous, soft tubes, closed at the apex, cylindrical or variously constricted, more or less aggregated; trichomes 4-5 mic. in diameter, numerous, erect, parallel or slightly curved; cells oblong or cylindrical, closely connected; heterocysts 6 mic. in diameter, oval or somewhat spherical, yellow or pale orange; gonidia 7 mic. in diameter, 15-22 mic. in length, numerous, cylindrical, catenate.

New Jersey. At first attached, afterwards floating free. Along the shores and in the shallow water of Cranberry Pond. (Wolle).

Genus **NODULARIA** Mertens.

Jürgens, Alg. Aquat. Dec. XV. no. 4. 1822.

Filaments free; sheaths colorless, close, usually thin, mucous, sometimes diffuent; trichomes more or less straight; cells short, depressed, disc-shaped; heterocysts depressed; gonidia spherical, somewhat spherical or disc-shaped, developed in series between the heterocysts; wall of gonidium smooth.

I Trichomes less than 8 mic. in diameter.

- 1 Filaments 4-6 mic. in diameter; gonidia 6-8 mic. in diameter, somewhat spherical **N. harveyana**
- 2 Filaments 6-7 mic. in diameter; gonidia 7-10 mic. in diameter, spherical depressed **N. sphaerocarpa**
- 3 Trichomes 6-8 mic. in diameter; cells short, about half as long as wide **N. paludosa**

II Filaments more than 8 mic. in diameter.

- 1 Trichomes 7.5-9.5 mic. in diameter; cells nearly as long as broad before division **N. hawaiiensis**
- 2 Filaments 10-11 mic. in diameter; gonidia 10-12 mic. in diameter, 9 mic. in length, spherical depressed, in series **N. armorica**
- 3 Filaments 8-18 mic. in diameter; gonidia 12-15 mic. in diameter, 6-10 mic. in length; somewhat spherical or elliptical **N. spumigena**
- 4 Trichomes (?) 33-38 mic. in diameter; cells short **N. mainensis**

340. **Nodularia harveyana** (Thwaites) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 378. 1875. Bornet and Flahault. Revis.

des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 243. 1888. De Toni. Syll. Algar. 5: 432. 1907.

Farlow. Marine Algae New England. 31. 1881. **Collins.** Algae of Middlesex County. 14. 1888. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 92. 1889. **Collins.** Preliminary Lists of New England Plants. V. Marine Algae. Rhodora. 2: 42. 1900. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 21. no. 1013. 1903; Fasc. 22. no. 1062. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 192. 1903. **West.** West Indian Fresh-water Algae. Journ. of Bot. 42: 291. 1904. **Tilden.** Notes on a Collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 155. 1908.

Plate IX. fig. 1, 2.

Filaments 4-6 mic. in diameter, tapering at the ends, terminated by an obtuse conical cell; sheaths thin, colorless, distinct; cells before division about as long as broad or a little longer; gonidia 8 mic. in diameter, somewhat spherical, yellowish brown.

Maine. In a high pool, exposed to spray only. Ragged Island, Casco Bay. July 1903. (Collins). **New Hampshire.** (Collins). **Massachusetts.** Found in small quantities, mixed with *Sphaerozyga*, in company with *Rhizoclonium*. Charles River, Cambridge; also in salt marshes. (Farlow). **Connecticut.** (Collins). **New York.** Mariners' Harbor, Staten Island. (Pike). **Nebraska.** In ponds and running water. South Bend. (Bessey). **Washington.** On mud by the roadside. Near La Conner, Skagit County. May 1901. (Gardner). **Central America.** Associated with *Phormidium valderianum*. Laguna Lake, Amatitlan (3,950 feet). February 1905. (Kellerman).

341. *Nodularia sphaerocarpa* Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 245. 1888. De Toni. Syll. Algar. 5: 433. 1907. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 22. no. 1063. 1903.

Plate IX. fig. 3.

Filaments 6-7 mic. in diameter, entangled; sheaths thin, colorless, finally diffuent; cells 6 mic. in diameter, 4 mic. in length; heterocysts about as large as the cells; gonidia 7-10 mic. in diameter, depressed spherical, brownish, two to twelve in series.

California. Forming a thin layer on the moist shady side of a sandy cliff. Bolinas, Marin County. May 1903. (Gardner).

342. *Nodularia paludosa* Wolle. Fresh-Water Algae U. S. 291. pl. 198. f. 3, 4. 1887. De Toni. Syll. Algar. 5: 435. 1907.

Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 4: 24. 1896.

Plate IX. fig. 4.

Filaments single or in small clusters; sheaths rarely present, soon diffuent; trichomes 6-8 mic. in diameter, nearly straight; cells short, about

half as long as wide; heterocysts nearly spherical, yellowish; cell contents granular, bright blue-green.

Colorado. (Wolle). **Pennsylvania.** (Wolle). **Nebraska.** In salt lake, Lincoln.

According to some authorities this species may belong to *Anabaena cupressaphila* or to *N. harveyana*.

343. *Nodularia hawaiiensis* Tilden. American Algae. Cent. V. no. 484. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901.

Plate IX. fig. 5.

Plant mass stringy, dark blue-green; sheaths not evident; trichomes 7.5-9.5 mic. in diameter; cells before division nearly as long as broad, depressed spherical; heterocysts 10 mic. in diameter, spherical or a little longer than broad; gonidia not known.

Hawaii. In tufts attached to other algae, on reef constantly washed over by waves. Waianae, Oahu. May 1900. (Tilden).

The filament has neither the distinct sheath and small diameter of that of *N. harveyana* nor the short Oscillatoria-like cells of *N. spumigena*, the only marine forms of *Nodularia* described by Bornet and Flahault. Until gonidia are found in the plant its affinities cannot be discovered.

344. *Nodularia armorica* Thuret. Notes Algologiques. 2: 122. pl. 29. 1880. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 245. 1888. De Toni. Syll. Algar. 5: 433. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 193. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 22. no. 1061. 1903.

Plate IX. fig. 6.

Filaments 10-11 mic. in diameter, entangled; sheaths very thin; cells compressed, one half as short as the diameter; heterocysts compressed, a little larger than the cells; gonidia 10-12 mic. in diameter, 9 mic. in length, depressed spherical, yellowish brown, arranged in series; end walls of gonidia firm, biconcave, transversely truncate.

Washington. Floating on the surfaces of quiet ponds. Near Coupeville, Whidbey Island; Port Townsend. (Gardner). **California.** In a shallow ditch. Oakland. May 1902. (Osterhout and Gardner).

345. *Nodularia spumigena* Mertens in Jürgens. Algae Aquaticae. Dec. XV. no. 4. 1822. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 245. 1888. De Toni. Syll. Algar. 5: 433. 1907.

Filaments entangled in a mucous mass, or scattered, sometimes floating free, somewhat straight or curled; sheaths sometimes thin, or in other cases quite thick; cells very short, disc-shaped, three or four times shorter than the diameter; heterocysts a little larger than the cells;

gonidia not contiguous to the heterocysts, often numerous, yellowish brown.

Var. *genuina* Bornet and Flahault. l. c. 246. De Toni. l. c. 433.

Riddle. Brush Lake Algae. Ohio Nat. 5: 268. 1905. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 27. no. 1307. 1906.

Filaments 8-12 mic. in diameter; gonidia usually 12 mic. in diameter, 8-9 mic. in length.

Maine. Among *Cladophora expansa*, etc., in marsh pools. Stover's Point, Harpswell. July 1906. (Collins). Ohio. Brush Lake, Champaign County. 1902. (Riddle).

Var. *litorea* (Kuetzing) Bornet and Flahault. l. c. 246. De Toni. l. c. 434.

Collins. Notes on New England Marine Algae. IV. Bull. Torr. Bot. Club. 11: 130. 1884; Preliminary Lists of New England Plants. V. Marine Algae. Rhodora. 2: 42. 1900.

Plate IX. fig. 7, 8.

Filaments 12-16 mic. in diameter; gonidia about 14 mic. in diameter, 10 mic. in length.

Maine. (Collins). New Hampshire. A few filaments among other algae in marshes. Hampton. (Collins). Massachusetts. (Collins).

Var. *major* (Kuetzing) Bornet and Flahault. l. c. 247. De Toni. l. c. 435.

Collins. Preliminary Lists of New England Plants V. Marine Algae. Rhodora. 2: 42. 1900. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 193. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1012. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905.

Filaments 12-18 mic. in diameter; gonidia 14-15 mic. in diameter, 6-7 mic. in length.

Connecticut. Scattered filaments among other blue-green algae. In marsh pool. Cook's Point. (Holden). Washington. In a pond of slightly brackish water. Penn's Cove, near Coupeville, Whidbey Island. June 1901. (Gardner).

346. *Nodularia mainensis* F. L. Harvey. The Fresh-water Algae of Maine. II. Bull. Torr. Bot. Club. 16: 188. 1889. De Toni. Syll. Algar. 5: 435. 1907.

Sheaths distinct but close; trichomes 33-38 mic. in diameter; cells 2-6 mic. in length; heterocysts compressed, oval, orange yellow or brownish yellow.

Maine. Found intermingled with *Vaucheria sessilis* in Pushaw Stream, a tributary of the Penobscot, near Orono. July 1888. (F. L. Harvey).

Genus *ANABAENA* Bory. Dict. Class. 1: 307. 1822.

Sheaths not present or when present often diffuent; trichomes equal throughout or tapering at the apices, usually rigid and fragile, sometimes

circinate, free or aggregated without order to form a flocculent mass; cells equal to or longer than their diameter; apical cells sometimes conical; heterocysts numerous and intercalary; gonidia variously disposed, sometimes solitary, sometimes lying on each side of a heterocyst, rarely in short catenate series.

I Gonidia oval or spherical.

- 1 Gonidia oval or barrel-shaped, remote from the heterocysts in catenate series

- | | |
|--------------------------------|----------------------|
| (1) Wall of gonidium smooth | <i>A. variabilis</i> |
| (2) Wall of gonidium papillose | <i>A. hallensis</i> |

- 2 Gonidia spherical, contiguous to heterocysts, solitary or in short series, 12-20 mic. in diameter *A. sphaerica*

II Gonidia variously disposed, sometimes contiguous to heterocysts, sometimes remote from them, cylindrical, straight or curved.

- 1 Trichomes usually circinate; gonidia curved, obliquely truncate at the apices

- (1) Gonidia 7-13 mic. in diameter, 20-50 mic. in length, curved, oblique, inequilateral, contiguous to or rarely remote from the heterocysts; wall of gonidium smooth, colorless or yellowish; trichomes 4-8 mic. in diameter *A. flos-aquae*

- (2) Gonidia 16-18 mic. in diameter, up to 30 mic. in length, curved, oblique or cylindrical, *the younger ones somewhat spherical, usually remote from the heterocysts; wall of gonidium smooth, colorless; trichomes 8-14 mic. in diameter *A. circinalis*

- 2 Trichomes straight; gonidia cylindrical, straight, usually remote from the heterocysts, solitary or in series

- (1) Trichomes 4-5 mic. in diameter; sheaths sometimes present; gonidia 14-17 mic. in length *A. inaequalis*

- (2) Trichomes 5-8 mic. in diameter; sheaths occasionally present; gonidia 7-10 mic. in diameter, up to 30 mic. and more in length *A. catenula*

- (3) Trichomes 4.2-6 mic. in diameter; sheaths present; gonidia 6 mic. in diameter, 14-20 mic. in length *A. laxa*

III Gonidia contiguous to heterocysts on each side, developed centripetally; cylindrical or somewhat cylindrical

- 1 Gonidia 7-12 mic. in diameter, 18-28 mic. in length, short, somewhat cylindrical, often slightly constricted in the center; apical cell conical *A. torulosa*

- 2 Gonidia 8-10 mic. in diameter, 20-40 mic. in length, especially cylindrical; apical cells obtuse *A. oscillarioides*

- 3 Gonidia 15-20 mic. in diameter, 50-90 mic. in length, cylindrical or more commonly tapering slightly from the middle to the rounded ends *A. bornetiana*

Species not well understood

- A. azollae
- A. confervoides
- A. cupressophila
- A. gelatinosa
- A. subrigida

347. *Anabaena variabilis* Kuetzing. Phyc. Gen. 210. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 226. 1888. De Toni. Syll. Algar. 5: 437. 1907.

Wolle. Fresh-Water Algae U. S. 287. pl. 198. f. 29-32. 1887. Bennett. Plants of Rhode Island. 114. 1888. (*Sphaerozyga polysperma* Rab.). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 429. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 107. 1895. Tilden. American Algae. Cent. II. no. 169. 1896. Richter. Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. 7: Heft. 42. 5. 1897. Setchell. Notes on Cyanophyceae. III. Erythea. 7: 51. 1899. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 709. 1900. Collins. Preliminary Lists of New England Plants. V. Marine Algae. Rhodora. 2: 41. 1900. Tilden. Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901; American Algae. Cent. V. no. 483. 1901; American Algae. Cent. VI. no. 678. 1902; Algae Collecting in the Hawaiian Islands. Postelsia. 1: 168. 1902. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 191. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 25. no. 1209. 1905. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 622. 1905. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 31. no. 1507. 1908. (*A. variabilis brachyspora* Collins).

Plate IX. fig. 9.

Plant mass gelatinous, spreading on damp soil or floating free, dark green; sheaths usually not present; trichomes 4-6 mic. in diameter, flexuous, slightly constricted at joints; apical cell obtuse conical; cells 2.5-6 mic. in diameter, somewhat quadrate; heterocysts 6 mic. in diameter, 8 mic. in length, spherical or oval; gonidia 7-9 mic. in diameter, 8-14 mic. in length, oval, truncate at the apices, numerous in catenate series, remote from heterocysts, developed centrifugally; wall of mature gonidium smooth, yellowish brown.

Greenland. Umanak. (Vanhöffen). Maine. Among various floating Algae in a warm pool above high water mark. Ragged Island, Casco Bay. July 1908. (Collins). Rhode Island. Spectacle Pond. (Bennett). Forming a brownish or bluish green, gelatinous layer on the floating leaves of *Ruppia maritima*, in brackish water. Watch Hill Pond, Watch Hill. September 1894. (Setchell). Connecticut. Fresh Pond. (Collins, Holden).

New Jersey. Fresh water. Somerset. (Setchell). In pools, Bound Brook. (Wolle). **Minnesota.** In stagnant water in pools made by high waves and seepage on beach. Oatka Beach. Minnesota Point, Duluth. August 1901. (Tilden). **South Dakota.** Artesian water into which sewage runs. Aberdeen. August 1895. (Griffiths). Floating in large light blue-green masses on the surface of a pond supplied with artesian water. September 1898. (Saunders). **Montana.** Common in open, muddy pools heated by the sun's glare; rising to the surface in small, frothy scummy masses. Ponds and semi-stagnant mud-bottomed parts of streams in the mountains and on the plains. June to November. (Anderson and Kelsey). **Wyoming.** On surface of water in ditch. Seven miles north of Lake Hotel, Yellowstone National Park. July 1896. (Tilden). **Idaho.** Standing water. Near Lewiston, Nez Perces County. (800 feet). 1896. (A. A. and E. G. Heller). **Washington.** In ditches and ponds. Whidbey Island; Seattle. (Gardner). **California.** San Francisco. (Setchell). In masses of *Ruppia maritima* in salt marsh pool. West Berkeley. August 1904. (Gardner). **Hawaii.** On bottom of irrigation ditches in sugar cane field. Water turned on about once a week. Ewa Plantation, Oahu. June 1900. (Tilden). Maluhia, Oahu. (Schauinsland).

348. *Anabaena hallensis* (Janczewski) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 227. 1888. De Toni. Syll. Algar. 5: 440. 1907.

Bessey, Pound and Clements. Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 12. 1901.

Plate IX. fig. 10-13.

Plant mass mucous, floating; sheaths gelatinous; trichomes 4-5 mic. in diameter, somewhat straight, with tapering apices; cells depressed spherical or somewhat quadrate; heterocysts 5 mic. in diameter, barrel-shaped; gonidia 7-8 mic. in diameter, 10-12 mic. in length, oblong-elliptical, truncate at the apices, usually remote from the heterocysts, developed centrifugally; wall of gonidium colorless, minutely papillose; cell contents granular; blue-green.

Nebraska. In aquaria. Lincoln. (Bessey).

349. *Anabaena sphaerica* Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 228. 1888. De Toni. Syll. Algar. 5: 440. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 192. 1903.

Plant mass floccose, blue-green; sheaths not distinct; trichomes 5-6 mic. in diameter, moniliform, straight, agglutinated together in parallel bundles; cells spherical or spherical-truncate; heterocysts 6-7 mic. in diameter, nearly spherical; gonidia 12 mic. in diameter, 12-18 mic. in length, spherical or somewhat oval, contiguous to heterocysts, in short series; wall of gonidium smooth, brownish yellow.

Washington. Floating on the surfaces of small ponds. Whidbey Island; Port Townsend. (Gardner).

Var. macrosperma Bornet and Flahault. l. c. 228. De Toni. l. c. 440.

Gonidia 20 mic. in diameter, spherical.

West Indies. Santa Cruz. (Hornemann).

350. *Anabaena flos-aquae* (Lyngbye) Brébisson in Brébisson and Godey. *Algues des Environs de Falaise*. 36. 1835. Bornet and Flahault. *Revis. des Nostoc*. Ann. Sci. Nat. Bot. VII. 7: 228. 1888. De Toni. *Syll. Algar.* 5: 441. 1907.

Wolle. *Fresh Water Algae*. III. Bull. Torr. Bot. Club. 6: 183. 1877. (*Trichormus incurvus* Allm.). Farlow. *Notes on Fresh-Water Algae*. Bot. Gaz. 8: 225. 1883. Wolle. *Fresh-Water Algae* U. S. 286. 1887. Bennett. *Plants of Rhode Island*. 114. 1888. Trelease. The "Working" of the Madison Lakes. Trans. Wis. Acad. Sci. Arts and Letters. 7: 122. pl. 10. f. 4. 1889. Wolle and Martindale. *Algae*. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. Saunders. *Proto-phyta-Phycophyta*. Flora of Nebraska. 18. 1894. Tilden. *List of Fresh-Water Algae collected in Minnesota during 1896 and 1897*. Minn. Bot. Studies. 2: 27. 1898; *American Algae*. Cent. III. no. 292. 1898. Fanning. *Observations on the Algae of the St. Paul City Water*. Minn. Bot. Studies. 2: 609. pl. 45. f. 21. 1901. Tilden. *American Algae*. Cent. VI. no. 576. 1902. Setchell and Gardner. *Algae of Northwestern America*. Univ. Calif. Pub. Bot. 1: 192. 1903. Nelson. *Observations upon some Algae which cause "Water Bloom."* Minn. Bot. Studies. 3: 56. pl. 14. f. 3. 1903. Moore and Kellerman. *A Method of Destroying and Preventing the Growth of Algae and Certain Pathogenic Bacteria in Water Supplies*. U. S. Dept. Agric. Bureau of Plant Industry. Bull. 64. 20. 1904. Riddle. *Brush Lake Algae*. Ohio Nat. 5: 268. 1905. Clark. *The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala*. Proc. Biol. Soc. Wash. 21: 98. 1908. Tilden. *Notes on a Collection of Algae from Guatemala*. Proc. Biol. Soc. Wash. 21: 155. 1908. Buchanan. *Notes on the Algae of Iowa*. Proc. Iowa Acad. Sci. 14: 12. 1908.

Plate IX. fig. 14.

Plant mass frothy, gelatinous, lubricous, floating, bluish in color; sheaths not present; trichomes 4-8 mic. in diameter, circinate; cells 6-8 mic. in length, compressed spherical; heterocysts a little wider and longer than the cells; gonidia 7-13 mic. in diameter, 20-50 mic. in length; curved, oblique, inequilateral, contiguous to or rarely remote from the heterocysts, often surrounded by a wide gelatinous sheath; wall of gonidium smooth, colorless or yellowish.

Greenland. (Börjesen). Rhode Island. Very common. (Bennett). New Jersey. Common on stagnant fresh water. (Wolle). District of Columbia. Washington. (Moore and Kellerman). Ohio. Brush Lake, Champaign County. Fall of 1902. (Riddle). Wisconsin. Forming a part of a greenish yellow scum which occurs every season in greater or less quantity on Third and Fourth Lakes (Mendota and Monona) during the hot weather of summer. (Trelease). Minnesota. (Farlow). Floating in abundance on surface of water. Cedar Lake, Hennepin County. October 1897. (Fanning and Humphrey). City water supply, St. Paul. (Fanning). Forming a pale, bluish green scum. Spring Park, Lake Minnetonka, Hennepin County. October 1901. (Nelson). Iowa. "One of the most common of the con-

stituents of the plankton of many of our lakes at some seasons of the year. Occurs frequently in the sloughs in the northern part of the state also." Jennings's Pond, near Boone River; slough, Eagle Grove, 1904. (Buchanan). **Nebraska.** Free-swimming, membranaceous, blue-green. (Saunders). **Washington.** Floating in great abundance on quiet water. Lake Union, Seattle. (Gardner). **Central America.** Very common in all the phyto-plankton from Lake Amatitlan, Guatemala. Winter of 1905-1906. (Meek). Very abundant, collected with a surface net. Lake Amatitlan. Temperature of water 73°. January 1906. (Kellerman, Meek and Smith).

Var. **treleasei** Bornet and Flahault. l. c. 230. De Toni. l. c. 443.

Trelease. The "Working" of the Madison Lakes. Trans. Wis. Acad. Sci. Arts and Letters. 123. pl. 10. f. 5. 1889. (*A. mendotae* Trelease).

Cells 4 mic. in diameter; heterocysts 5 mic. in diameter, 10 mic. in length; gonidia 6 mic. in diameter, 40 mic. in length, slightly curved.

Wisconsin. Forming a copious water bloom on Lake Mendota, at Madison, especially abundant in the fall. (Farlow).

351. **Anabaena circinalis** Rabenhorst. Alg. Eur. Exsicc. no. 209. 1852. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 230. 1888. De Toni. Syll. Algar. 5: 443. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 38. pl. 3. f. 5. 1874. (*A. gigantea* Wood). **Farlow.** Notes on Fresh-Water Algae. Bot. Gaz. 8: 225. 1883. (*A. flos-aquae circinalis* Kirchn.). **Arthur.** Some Algae of Minnesota supposed to be Poisonous. Bull. Minn. Acad. Nat. Sci. 2: (App.) 1-12. 1883. **Bennett.** Plants of Rhode Island. 114. 1888. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 18. pl. 1. f. 12. 1894. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895. **Jackson and Ellms.** On Odors and Tastes of Surface Waters, with Special Reference to *Anabaena*, a Microscopical Organism found in Certain Water Supplies of Massachusetts. Review Am. Chem. Research. 8: 410. 1897. **Nelson.** Observations upon some Algae which cause "Water Bloom." Minn. Bot. Studies. 3: 56. pl. 14. f. 2. 1903. **Moore and Kellerman.** A Method of Destroying or Preventing the Growth of Algae and Certain Pathogenic Bacteria in Water Supplies. U. S. Dept. Agric. Bureau of Plant Industry. Bull. 64. 20. 1904. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 27. no. 1308. 1906. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 12. 1908.

Plate IX. fig. 15.

Plant mass frothy; sheaths often not present; trichomes 8-14 mic. in diameter, usually circinate, sometimes straight; cells a little shorter than the diameter, spherical compressed; heterocysts 8-10 mic. in diameter, somewhat spherical; gonidia 16-18 mic. in diameter, up to 30 mic. in length, curved, oblique or cylindrical, the younger ones somewhat spherical, usually remote from the heterocysts; wall of gonidium smooth, colorless.

Massachusetts. Horn Pond, Woburn; South Framingham, November 1882. (Farlow). Ludlow Reservoir, Springfield. Fall of 1895. (Jackson and Ellms). Forming a scum on a small pond. Medford. June 1906. (Collins).

Rhode Island. Providence. (Lathrop). R. W. Park. (Bennett). **New York.** Chautauqua Lake. (Wolle). **Pennsylvania.** Floating upon a brick pond, forming a part of a thick, dirty green, "pea-soup" colored, almost pulverulent scum. (Wood). **District of Columbia.** Washington. (Moore and Kellerman). **Minnesota.** Lake Tetonka, Waterville. 1882. (Arthur). Floating on a pond. Union Park, Minneapolis. August 1882. (Butler). Floating in large quantities at edge of lake. Lake Calhoun, Hennepin County. October 1894. (Tilden). Spring Park, Lake Minnetonka. October 1901. (Nelson). **Iowa.** Very common in the lakes. East Okoboji Lake; Upper Gar Lake. October 1904. (Buchanan). **Nebraska.** Gives a bluish green color to stagnant water, or in age forms a blue-green scum on the surface. (Saunders).

352. *Anabaena inaequalis* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 231. 1888. De Toni. Syll. Algar. 5: 446. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1165. 1904.

Plate IX. fig. 16.

Plant mass floccose, floating or climbing to other algae, blue-green; sheaths distinct, especially around the gonidia; trichomes 4-5 mic. in diameter, straight, parallel, sometimes free, sometimes surrounded by a firm mucus; apex of trichome scarcely tapering; apical cell obtuse; cells spherical-truncate; heterocysts 6 mic. in diameter, spherical; gonidia 6-8 mic. in diameter, 14-17 mic. in length, remote from the heterocysts, developed centrifugally, two or three in a series; wall of gonidium smooth, yellowish.

California. Lake Chabot, San Leandro. June 1902. (Osterhout and Gardner).

353. *Anabaena catenula* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 232. 1888. De Toni. Syll. Algar. 5: 447. 1907.

Wolle. Fresh-Water Algae U. S. 290. pl. 199. f. 17-24. 1887. (*Sphaerocyga smithii* (Thw.) Wolle). **Bessey.** Miscellaneous Additions to the Flora of the State. Bot. Surv. Nebraska. 46. 1893. **Saunders.** Proto-phyta-Phycophyta. Flora of Nebraska. 18. pl. 1. f. 9, 10. 1894. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 11. no. 506. 1898. **Collins.** Notes on Algae.—I. Rhodora. 1: 10. 1899. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 192. 1903.

Plate IX. fig. 17.

Plant mass gelatinous, floating, blue-green; sheaths diffuent in mature plants; trichomes 5-8 mic. in diameter, flexuous; apical cell rotund; cells barrel-shaped, usually a little shorter than the diameter; heterocysts 6-9 mic. in diameter, 9-13 mic. in length, somewhat spherical or oblong; gonidia 7-10 mic. in diameter, 16-30 mic. in length, cylindrical, often slightly con-

stricted in the center, with round-truncate apices, contiguous to the heterocysts or remote from them, developed centrifugally, usually in catenate series; wall of gonidium smooth, pale smoke-colored.

Alaska. Floating on shallow ponds or sluggish streams. Huntville, Unalaska. (Setchell and Lawson). Glacier Valley, Unalaska. (Lawson). **Maine.** In a ditch just above the beach. Eagle Island, Penobscot Bay. July 1896. (Collins). **Massachusetts.** On dead leaves, in swamp near Bear's Den Path, Middlesex Fells; Penny Brook, Lynn Woods, July 1905. (Collins). **Nebraska.** In moist places in greenhouses. (Bessey, Saunders). **Washington.** Near Coupeville, Whidbey Island; Green Lake, Seattle. (Gardner). **Hawaii.** In stagnant water. Kauai. July 1900. (Tilden).

Var. *americana* Collins. New Cyanophyceae. Erythea. 4: 119. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 207. 1896. Collins. Notes on Algae.—I. Rhodora. 1: 10. 1899. De Toni. 1. c. 448.

Gonidia 30-60 mic. in length, strictly cylindrical.

Massachusetts. In company with other algae, forming a scum in pools and ditches. Middlesex Fells. June 1893. (Collins).

354. *Anabaena laxa* (Rabenhorst) A. Braun in Bornet and Flahault. Note sur le Genre Aulosira. Bull. Soc. Bot. de France. 32: 120. pl. 4. f. 2, 3. 1885; Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 233. 1888. De Toni. Syll. Algar. 5: 451. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 30. no. 1454. 1908.

Plate IX. fig. 18.

Sheaths colorless, scarcely conspicuous; filaments 7 mic. in diameter; trichomes 4.2-6 mic. in diameter; cells barrel-shaped, about as long as broad; gonidia 6 mic. in diameter, 14-20 mic. in length, cylindrical, with rotund apices; wall of gonidium smooth, colorless.

Massachusetts. Penny Brook, Lynn Woods. July 1905. (Collins).

355. *Anabaena torulosa* (Carmichael) Lagerheim. Bidrag till Sveriges Algflora. Oefversigt af K. Vet.-Akad. Förhandl. 47. 1883. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 236. 1888. De Toni. Syll. Algar. 5: 455. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 42. pl. 3. f. 3. 1872. (*Dolichospermum polysperma* (Kg.) Wood). Farlow. Marine Algae United States. Proc. Am. Acad. Arts Sci. 10: 380. 1875. (*Sphaerozyga carmichaelii* Harv.); Report of the U. S. Fish Commission for 1875. 715. 1876; Marine Algae of New England. 30. pl. 1. f. 3. 1881. Pike. Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. Wolle. Fresh-Water Algae U. S. 289. pl. 198. f. 37, 38. 1887. (*Sphaerozyga polysperma* Rab.). Collins. Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888; Algae of Middlesex County. 14. 1888; Marine Algae of Nantucket. 4. 1888. Martindale. Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 92. 1889. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 18. pl. 1. f. 8. 1894.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 8. no. 354. 1897. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905.

Plate IX. fig. 19.

Plant mass mucous, thin, blue-green; trichomes 4.2-5 mic. in diameter; apical cell acute conical; cells barrel-shaped, equal to or a little shorter than the diameter; heterocysts 6 mic. in diameter, 6-10 mic. in length, somewhat spherical or ovoid; gonidia 7-12 mic. in diameter, 18-28 mic. in length, short, somewhat cylindrical, often slightly constricted in the center, contiguous to the heterocysts, developed centripetally; wall of gonidium smooth, pale smoke-colored in mature specimens.

Maine. On *Zostera*. Goose Creek marshes, Cape Rosier. July 1896. (Collins). New Hampshire. (Collins). Massachusetts. On decaying algae, looking like a shining emerald-green film. Wood's Hole; Gloucester; Cambridge; salt marshes, Everett. (Farlow). Not uncommon on mud in the harbor; on decaying *Zostera marina*, Mattapoisett, September 1906. (Collins). Rhode Island. (Collins). Connecticut. Noank. (Farlow). On mud on margin of marsh pools. Cook's Point; on muddy sand, near high water mark, among *Spartina*, shore of The Gut, June. (Holden). New York. On decayed algae. Fort Hamilton; Greenport. (Pike). Fresh water. Somerset; in pools, Bound Brook. (Wolle). New Jersey. With other algae, forming a brownish jelly, in a pool east of Camden. (Wood). Newark Bay. (Pike). Atlantic City. (Morse, Martindale). Nebraska. In stagnant water, usually among other algae; also on damp earth, on flower pots, in greenhouses at the University. Lincoln. (Saunders).

356. *Anabaena oscillarioides* Bory. Dictionnaire Classique d'Histoire Naturelle. 1: 308. 1822. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 233. 1888. De Toni. Syll. Algar. 5: 451. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 40. pl. 3. f. 1. a, b. 1872. (*Cylindrospermum flexuosum* Rab.). Wolle. Fresh-Water Algae U. S. 292. pl. 199. f. 13. 1887. Bennett. Plants of Rhode Island. 114. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. Tilden. American Algae. Cent. I. no. 87. 1894. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 19. 1894. Tilden. List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895. Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. Setchell. Notes on Cyanophyceae. III. Erythea. 7: 51. 1899. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 14. no. 656. 1900; Fasc. 19. no. 907. 1902. Kellerman. Proposed Algological Survey of Ohio. Ohio Nat. 2: 222. 1902. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 192. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate IX. fig. 20.

Plant mass gelatinous, dark green; trichomes 4.2-6 mic. in diameter, with rotund apical cells; cells barrel-shaped, equal to the diameter in length, or a little shorter or longer; heterocysts 6-8 mic. in diameter, spherical, or 6 mic. in diameter and 10 mic. in length, ovoid; gonidia 8-10 mic. in diameter, 20-40 mic. in length, when young ovoid, finally becoming especially cylindrical, solitary or in series, with rounded apices, contiguous to the heterocysts, developed centripetally; wall of gonidium smooth, in mature specimens very pale soot-colored.

Massachusetts. On dead leaves, in swamp near Bear's Den Path, Middlesex Fells. (Collins). Wood's Hole. (Humphrey and Miyabe). In still water. West Falmouth. August 1896. (Humphrey). **Rhode Island.** Roger Williams Park. (Bennett). **Connecticut.** Pool below Factory Pond, Bridgeport. (Holden). **New Jersey.** In brackish ditches. (Wolle). **Pennsylvania.** "In a dark little grotto, formed by shelving rocks." Reading Railroad, just above the Flat Rock tunnel; on wet ground by a horse-trough, near west end of upper bridge at Manayunk; on banks of Schuylkill River, in vicinity of Philadelphia. (Wood). On dripping rocks and on wet ground. (Wolle). **Ohio.** (Kellerman). **Illinois.** Evanston. (Johnson). **Minnesota.** Second Creek, Lake City, Wabasha County. September 1894. **South Dakota.** In a slough. Elm River, eight miles north of Aberdeen. May 1896. (Griffiths). **Nebraska.** In a small creek near Lincoln. (Saunders). **Montana.** Helena. (Kelsey). **Washington.** On moist bank near bicycle path. Madrona Park, Seattle. May 1901; floating on pools and lakes, or on moist ground, Coupeville, Whidbey Island; Port Townsend. (Gardner). **California.** San Francisco. (Setchell).

Var. *elongata* (Kuetzing) Bornet and Flahault. l. c. 236. De Toni. l. c. 453.

Tilden. American Algae. Cent. III. no. 293. 1898.

Heterocysts 7-9 mic. in diameter, very long, 6-18 mic. in length; gonidia up to 70 mic. in length.

South Dakota. Floating in stagnant water on prairie. Columbia. June 1897. (Griffiths).

Var. *stenospora* Bornet and Flahault. l. c. 236. De Toni. l. c. 454.

Tilden. American Algae. Cent. II. no. 172. 1896; Cent. VI. no. 577. 1902. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 31. no. 1506. 1908.

Trichomes more slender; apical cell acute conical; gonidia 5-10 mic. in diameter, 16-40 mic. in length, often two to eight in a chain; wall of gonidium smooth, colorless.

Massachusetts. Forming rather thin films on plants and boards in a ditch. Eastham. August 1908. (Collins). **Minnesota.** Floating on surface of shallow pool on sandy or muddy beach. Minnesota Point, Duluth. August 1901. **Colorado.** On aquatic plants in slowly flowing stream in swamp. Five miles southeast of Port Collins. July 1896. (Cowen).

357. *Anabaena bornetiana* Collins. New Cyanophyceae. Erythea. 4: 120. 1896; in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 208. 1896. De Toni. Syll. Algar. 5: 457. 1907.

Trichomes 12 mic. in diameter, straight or somewhat flexuous; cells spherical or slightly shorter than their diameter; heterocysts 13-14 mic. in diameter, 13-20 mic. in length, spherical or occasionally oblong; gonidia 15-20 mic. in diameter, 50-90 mic. in length, cylindrical or more commonly tapering slightly from the middle to the rounded ends, contiguous to heterocysts on each side; wall of gonidium smooth, translucent.

Massachusetts. Occurring usually in isolated filaments among other algae in ditches and pools, often with other species of *Anabaena*. Malden, Medford, Middlesex Fells. May, June 1896. (Collins).

358. *Anabaena azollae* Strasburger. Das Botanische Practicum. 352. f. 124. 1884. De Toni. Syll. Algar. 5: 457. 1907.

Tilden. American Algae. Cent. II. no. 170. 1896; List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 27. 1898. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 16. no. 754. 1900.

Sheaths not present; trichomes snake-like in shape, aggregated in small bundles; cells 5 mic. in diameter, 8 mic. in length, usually somewhat spherical or ellipsoidal, cylindrical, with rotund apices; heterocysts up to 10 mic. in diameter, oval, easily distinguished from the olive contents and polar nodules ("cellulose buttons"); cell contents lead-colored-green; gonidia unknown.

Minnesota. In chambers in the leaves of *Azolla caroliniana*. University Plant House, Minneapolis. September 1896. (Tilden). **California.** Endophytic in *Azolla caroliniana*, growing in pools in the bed of Los Angeles River, Los Angeles. November 1900. (Monks).

359. *Anabaena confervoides* Reinsch. On Fresh-Water Algae from Kerguelen's Island. Journ. Linn. Soc. Bot. 15: 208. 1877. De Toni. Syll. Algar. 5: 461. 1907.

Tilden. American Algae. Cent. V. no. 482. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901.

Plate IX. fig. 21.

Plant mass thin; trichomes 2.2-2.8 mic. in diameter, slender, extremely long, very straight, parallel, surrounded by a common mucus; cells very distinct, rectangular, slightly longer than broad; heterocysts a little larger than the cells, elliptical; cell contents finally granular, pale blue-green; gonidia unknown.

Hawaii. Floating at edge of taro patch. Near Hauula Courthouse, Hauula, Koolauloa, Oahu. June 1900. (Tilden).

360. *Anabaena cupressophila* Wolle. Fresh-Water Algae U. S. 288. pl. 198. f. 1, 2. 1887. De Toni. Syll. Algar. 5: 458. 1907.

Wolle and Martindale. Algae. Britton's Catalogue of Plants found in

New Jersey. Geol. Surv. N. J. 2: 607. 1889.

Plate IX. fig. 22.

Plant mass gelatinous, somewhat membranaceous, deep blue-green; filaments 7-8 mic. in diameter; sheaths delicate; trichomes moniliform, slightly curved or nearly straight, more or less parallel; cells about half as long as wide, sometimes separated; heterocysts compressed globose, homogeneous, brownish yellow; cell contents granular, light blue-green.

New Jersey. On the trunks of trees, low down near the water's edge in swamps. (Wolle).

361. *Anabaena gelatinosa* Wood. Contr. Hist. Fresh-Water Algae North America. 38. pl. 2. f. 4. 1872. De Toni. Syll. Algar. 5: 461. 1907.

Plant mass gelatinous, mucous, indefinitely expanded, somewhat pellucid, with a brownish tinge; sheaths not present; trichomes somewhat curved, rather distant, not entangled; cells globose; heterocysts about equal to the cells in diameter, spherical or rarely oblong; cell contents homogeneous, light golden yellow or light blue-green; gonidia spherical, terminal.

Pennsylvania. Near Philadelphia. (Wood).

362. *Anabaena subrigida* (Wood) De Toni. Syll. Algar. 5: 461. 1907. Wood. Contr. Hist. Fresh-Water Algae North America. 42. pl. 3. f. 2. 1872. (*Dolichospermum subrigidum* Wood).

Plant mass floating; trichomes single, straight or nearly so, very small; cells cylindrical or somewhat spherical, distinct; heterocysts cylindrical, short, single, distinct; gonidia single or in pairs, slightly constricted in the center, not contiguous to heterocysts; cell contents light green.

Pennsylvania. In scum floating on ditches. Near Philadelphia. (Wood).

Genus **APHANIZOMENON** Morren.

Hist. Genre Nouv. Conf. 11: 11. 1838.

Colonies thin, feathery, plate-like or spindle-shaped bundles, blue-green, floating; sheaths not present; trichomes short, tapering at the ends, agglutinated; heterocysts scattered; gonidia cylindrical, much elongated, solitary, developed sparingly between the heterocysts.

363. *Aphanizomenon flos-aquae* (Linn.) Ralfs. On the Nostochineae. Ann. Mag. of Nat. Hist. 5: 340. pl. 9. f. 6. 1850. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 241. 1888. De Toni. Syll. Algar. 5: 468. 1907.

Arthur. Some Algae of Minnesota Supposed to be Poisonous. Bull. Minn. Acad. Nat. Sci. 2: (App.) 1. 1883. Wolle. Fresh-Water Algae U. S. 291. pl. 198. f. 7, 8. 1887. Tilden. American Algae. Cent. II. no. 173. 1896; List of Fresh-Water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896. Riddle. Algae from Sandusky Bay. Ohio Nat. 3: 317. 1902. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am.

Fasc. 23. no. 1107. 1903. **Nelson.** Observations upon some Algae which cause "Water Bloom." Minn. Bot. Studies. 3: 53. pl. 14. f. 1. 1903. **Riddle.** Brush Lake Algae. Ohio Nat. 5: 268. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 28. no. 1359. 1907.

Plate X. fig. 1.

Colonies small, aggregated in membranaceous flakes, fragile, blue-green; trichomes 5-6 mic. in diameter, rigid, tapering at the ends; cells somewhat quadrate, 5-15 mic. in length; heterocysts 6-7 mic. in diameter, 15-20 mic. in length, somewhat cylindrical; gonidia 7-8 mic. in diameter, 60-80 mic. in length, cylindrical, elongate, containing granular protoplasm; wall of gonidium smooth, colorless.

Massachusetts. Floating on quiet water. Medford. October 1906. (Lambert). **Ohio.** Sandusky Bay; Brush Lake. (Riddle). Plankton. Put-in-Bay, Lake Erie. (Snow). **Minnesota.** Lake Tetonka, Waterville. 1882. (Arthur). Lake of the Woods. July 1894. (MacMillan). Lake Minnetonka. 1895. (Crocker). On surface of water around edges in quiet bays during summer and early autumn. Long Lake, Hennepin County. September 1895. (Shaver and Tilden). In a shallow lake in the depressions of the Fergus Falls moraine, Fergus Falls. August 1900. (Ballard). **California.** Floating on Lake Chabot, San Leandro. June 1902. (Gardner).

Genus **CYLINDROSPERMUM** Kuetzing. Phyc. Gen. 211. 1843.

Plant mass expanded, indefinite, mucous; sheaths not present; trichomes equal, short, embedded in an amorphous mucus; cells cylindrical, longer than their diameter; heterocysts terminal, solitary; gonidia developed from the cell or cells next the heterocyst, generally solitary, rarely seriate.

I Gonidia solitary.

1 Gonidia cylindrical, up to 40 mic. in length

- (1) Gonidia 10-16 mic. in diameter, 32-40 mic. in length
C. stagnale
- (2) Gonidia 11-12 mic. in diameter, 23-24 mic. in length
C. comatum

2 Gonidia oblong or ventricose-elliptical

(1) Wall of gonidium punctate

- A Gonidia 10-15 mic. in diameter, 20-38 mic. in length, ventricose-elliptical; wall of mature gonidium rough, punctate
C. majus
- B Gonidia 6-6.5 mic. in diameter, 16-19 mic. in length, elliptical; wall of gonidium very finely granular
C. minutum

(2) Wall of gonidium smooth

- A Gonidia 8-9 mic. in diameter, 18-20 mic. in length
C. minutissimum
- B Gonidia 9-12 mic. in diameter, 18-20 mic. in length
C. muscicola

C Gonidia 12-14 mic. in diameter, 20-38 mic. in length

C. licheniforme

II Gonidia seriate

C. catenatum

364. *Cylindrospermum stagnale* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 250. 1888. De Toni. Syll. Algar. 5: 472. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 40. pl. 2. f. 7. 1872. (*C. macrospermum* Kg., *Anabaena stagnalis* Kg.) Wolle. Fresh-Water Algae U. S. 292. pl. 199. f. 6-8. 1887. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 145. 1891. Tilden. List of fresh-water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894. (*Cylindrospermum limnicola* Kuetz.) Collins. Notes on Algae.—IV. Rhodora. 3: 289. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 18. no. 856. 1901. Tilden. American Algae. Cent. V. no. 481. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901; Algae collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 168. 1902. Kellerman. Proposed Algological Survey of Ohio. Ohio Nat. 2: 222. 1902. Clark. The Holophytic Plankton of Lakes Atitlan and Amatitlan, Guatemala. Proc. Biol. Soc. Wash. 21: 97. 1908. Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 12. 1908.

Plate X. fig. 2.

Plant mass floccose, expanded, attached or floating; trichomes 3.8-4.5 mic. in diameter, slightly constricted at joints; cells up to three or four times longer than their diameter; heterocysts 6-7 mic. in diameter, up to 16 mic. in length, somewhat spherical, often oblong; gonidia 10-16 mic. in diameter, 32-40 mic. in length, cylindrical, with rotund apices; wall of gonidium smooth, yellowish brown; cell contents pale blue-green.

Maine. Forming a dense bluish green or brownish scum on the surface of an artificial pond at the Pogy Oil Factory, Bristol, near Round Pond Village. July 1901. (Collins). New Jersey. Frequent in wet places on dead wood. (Wolle). South Carolina. "In bottom of shallow, slowly running streams, adhering to ground or fallen leaves, etc., gelatinous, green." Near Aiken. September. (Ravenel). Ohio. (Kellerman). Minnesota. Irving Chase Lake. July 1893. (Tilden). Iowa. Iowa City. (Hobby). Montana. Ponds and semi-stagnant, mud-bottomed parts of streams in the mountains and on the plains. Common throughout. June to November. (Anderson and Kelsey). Central America. On surface of water. Lake Amatitlan, Guatemala. February 1906. (Meek). Hawaii. On wet cliffs. Laupahoehoe, Hawaii. July 1900. (Tilden).

365. *Cylindrospermum comatum* Wood. Contr. Hist. Fresh-Water Algae North America. 41. pl. 2. f. 1872. Wolle. Fresh-Water Algae U. S. 293. pl. 199. f. 16. 1887.

Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 12. 1908.

Plate X. fig. 3.

Plant mass gelatinous, blue-green, sometimes tinged on the edges with brown; trichomes 3 mic. in diameter, flexuous, equal, intricate, not spiral; cells short cylindrical, equal to or more than twice as long as the diameter, usually separated; apical cells somewhat spherical; gonidia 10-12 mic. in diameter, 23-24 mic. in length, oblong-cylindrical, granular, yellowish brown; wall of gonidium thick, distinctly granulate; cell contents granular, pale blue-green.

Canada. Growing upon the ground in the marshes which border the Niagara River, just above the Canadian Falls. (Wood). Iowa. Frequent on wet soil along brooks. Grinnell. (Fink).

366. *Cylindrospermum majus* Kuetzing. Phyc. Gen. 212. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 252. 1888. De Toni. Syll. Algar. 5: 474. 1907.

Collins. Algae of Middlesex County. 14. 1888. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. no. 106. 1895. Setchell. Notes on Cyanophyceae.—III. Erythea. 7: 51. 1899. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 15. no. 708. 1900; Fasc. 23. no. 1108. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate X. fig. 4.

Plant mass widely expanded, mucous, blackish green; trichomes 4-5 mic. in diameter, constricted at joints; cells 5-6 mic. in length, cylindrical; heterocysts a little wider than the cells, up to 10 mic. in length, oblong, pale; gonidia 10-15 mic. in diameter, 20-38 mic. in length, ventricose-elliptical; wall of mature gonidium rough, punctate.

Maine. Not immersed, but forming gelatinous masses on steep bank above the shore. South Harpswell. July 1903. (Collins). Massachusetts. Newton. (Farlow). On walls of B. and A. R. R. tunnel. (Wood). Connecticut. Investing grasses, *Utricularia*, etc., in still water. Pool below Factory Pond, Bridgeport. September 1891. (Holden). California. In a slow stream near Pasadena. (McClatchie).

367. *Cylindrospermum minutum* Wood. Contr. Hist. Fresh-Water Algae North America. 39. pl. 2. f. 6. 1872. De Toni. Syll. Algar. 5: 475. 1907.

Wolle. Fresh-Water Algae U. S. 292. pl. 199. f. 11. 1887. (*C. limnicola* Wolle). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 607. 1889. Bessey. Miscellaneous Additions to the Flora of the State. Bot. Surv. Nebraska. 46. 1893. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 19. pl. 1. f. 11. 1894. Tilden. List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 31. 1894.

Plate X. fig. 5.

Plant mass rust-colored, gelatinous; trichomes 2.8 mic. in diameter, generally curved and entangled, sometimes straight, more or less constricted at the joints; cells cylindrical; heterocysts hirsute, spherical; gonidia 6-6.5 mic. in diameter, 16-19 mic. in length, elliptical, very minutely granulate; cell contents homogeneous or granular, light blue-green.

New Jersey. Forming, with other algae, a ferruginous brown, gelatinous mass, growing in a deep, shaded, very stagnant pool. Spring Garden. (Wood). In wet places on dead wood. (Wolle). **Minnesota.** Irving Chase Lake. July 1893. (Tilden). **Nebraska.** Lincoln. (Bessey). Forms light green, slimy strata on pots in greenhouse. Lincoln. (Saunders).

368. *Cylindrospermum minutissimum* Collins. New Cyanophyceae. Erythea. 4: 120. 1896; Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 26. no. 1256. 1905. De Toni. Syll. Algar. 5: 472. 1907.

Plant mass loose, blue-green; trichomes 2-2.5 mic. in diameter, straight, not constricted at joints; cells cylindrical, very slender, 4-5 mic. in length; heterocysts 4 mic. in diameter, 7-8 mic. in length, cylindrical-oblong; gonidia 8-9 mic. in diameter, 18-20 mic. in length; wall of gonidium smooth, translucent (in not quite ripe gonidia).

Massachusetts. Among other algae in a scum in a ditch. Malden. October 1890. (Collins).

- ✓ 369. *Cylindrospermum muscicola* Kuetzing. Phyc. Germ. 173. 1845. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 254. 1888. De Toni. Syll. Algar. 5: 477. 1907.

Collins. Algae of Middlesex County. 14. 1888. **Tilden.** American Algae. Cent. II. no. 174. 1896. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 193. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 27. no. 1306. 1906.

Plate X. fig. 6.

Plant mass expanded, mucous, blackish green; trichomes 3-4.7 mic. in diameter, cylindrical, slightly constricted at joints; cells 4 mic. in length; heterocysts 4 mic. in diameter, 5-7 mic. in length, oblong; gonidia 9-12 mic. in diameter, 10-20 mic. in length, oval, orange brown; wall of gonidium smooth; cell contents pale blue-green.

Maine. On steep, wet clay bank. Harpswell. July 1906. (Collins). **Massachusetts.** Cambridge. (Farlow). On moist ground, Medford. September 1906. (Lambert). **Washington.** In a small stream of running water. Orcas Island. (Gardner). **California.** In slowly running water. Pasadena. December 1895. (McClatchie). **West Indies.** On sides of basin. Constant Spring; on sand at edge of river, Castleton. April 1893. (Humphrey).

370. *Cylindrospermum licheniforme*. (Bory) Kuetzing. Diagnosen und Bemerkungen. Bot. Zeit. 5: 197. 1847. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 253. 1888. De Toni. Syll. Algar. 5: 476. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 309. 1897. Setchell. Notes on Cyanophyceae. III. Erythea. 7: 52. 1899. Tilden. American Algae. Cent. VI. no. 575. 1902. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 193. 1903.

Plant mass mucous, orbicular-confluent, finally becoming widely expanded, very deep blackish green; trichomes 4.2 mic. in diameter, slightly constricted at joints; cells 4-5 mic. in length; heterocysts 5-6 mic. in diameter, 7-12 mic. in length, oblong; gonidia 12-14 mic. in diameter, 20-38 mic. in length, oblong or ventricose-elliptical, with truncate apices; wall of gonidium smooth, brownish or reddish; cell contents pale blue-green.

New York. Ithaca. (Atkinson). Minnesota. On stones at edge of river, near quarry. St. Louis River, Fond du Lac, near Duluth. August 1901. (Tilden). Washington. On mud or moist sand. Near Oak Harbor, Whidbey Island; near Mt. Vernon, Skagit County; near Seattle. (Gardner). California. Growing upon a bank within reach of salt spray. Bolinas, Marin County. (Setchell).

371. *Cylindrospermum catenatum* Ralfs. On the Nostochineae. Ann. and Mag. of Nat. Hist. 5: 338. 1850. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 254. 1888. De Toni. Syll. Algar. 5: 477. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. II. no. 505. 1898. Collins. Notes on Algae.—I. Rhodora. 1: 9. 1899. Tilden. American Algae. Cent. IV. no. 395. 1900. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 193. 1903.

Plate X. fig. 7.

Plant mass mucous, orbicular-confluent, indefinite, blackish green; trichomes 4 mic. in diameter, constricted at joints; cells 4-5 mic. in length; heterocysts 4 mic. in diameter, 6-7 mic. in length, oblong; gonidia 7-10 mic. in diameter, 13-18 mic. in length, oblong, two to eight in series; wall of gonidium smooth, orange brown.

Massachusetts. Forming a dark thin coating on the ground, looking as if a little black paint had been spilled and dried. On moist earth near Spot Pond, Middlesex Fells. August and September 1897. (Collins). Washington. Floating in stagnant place in stream. Tracyton, Kitsap County. July 1898. (Tilden). Hawaii. At edge of mountain stream. Kaliuwa Stream, Makao, Koolauloa, Oahu. June 1900. (Tilden).

Genus *RICHELIA* Johs. Schm.
Vid. Medd. Nat. Foren Kjöb. 147. 1901.

Sheaths not present; trichomes single, endophytic; heterocysts solitary, situated at the base of the trichome.

372. *Richelia intracellularis* J. Schm. Plankton fra det Røde Hav og Adenbugten. Vid. Medd. fra. d. Nat. Foren. Kjöb. 147. 1901. De Toni. Syll. Algar. 5: 480. 1907.

Plate X. fig. 8.

Trichomes 5.6-9.8 mic. in diameter, 50-105 mic. in length, short, straight or nearly straight, thickened at the apices, living as endophytes in the cells of *Rhizosolenia styliformis*; heterocysts 9.8-11.2 mic. in diameter, spherical or somewhat spherical, single, basal; cells somewhat spherical or barrel-shaped; apical cell often a little larger than the others, somewhat spherical; cell contents finely granular, or showing a few large granules, pale blue-green.

Hawaii. Plankton. On *Rhizosolenia* and *Hemiaulus delicatulus* Lemm. (Schauinsland).

Genus **AULOSIRA** Kirchner.

Krypt. von Schles. Algen. 238. 1878.

Filaments free, equal, scattered or in fascicles; sheaths membranaceous, close; cells cylindrical or barrel-shaped; heterocysts intercalary; gonidia developed at intervals between the heterocysts, remote from or contiguous to them, cylindrical, in catenate series.

373. *Aulosira schauinslandii* Lemmermann. Die Algenflora der Sandwich-Inseln. Bot. Jahrb. 34: 622. pl. 7. f. 9-11. 1905. De Toni. Syll. Algar. 5: 482. 1907.

Plate X. fig. 9.

Filaments 10-11 mic. in diameter, flexuous or spiral; sheaths firm, colorless; trichomes 9.5 mic. in diameter, slightly constricted at joints; apical cell hemispherical, about 8 mic. in length, containing coarse granules; cells 3 mic. in length, short; heterocysts usually 9.5 mic. in diameter, 11 mic. in length, always intercalary, somewhat spherical or cylindrical; gonidia not known.

Hawaii. On *Turbinaria*. Laysan. (Schauinsland).

Genus **MICROCHAETE** Thuret.

Essai Class. Nostochinées. 7. 1875.

Plants small, living in fresh or salt water, aggregated into star-shaped or cushion-shaped tufts; filaments unbranched, erect, attached at the base; sheaths present; trichomes single within the sheath; heterocysts basal and intercalary; gonidia developed from the lower cells.

I Plants living in fresh water; heterocysts basal and intercalary.

- 1 Filaments 4.4-5.1 mic. in diameter; sheaths colorless, wide
M. tenuissima
- 2 Filaments 10 mic. in diameter; sheaths simple, thin, close
M. tenera
- 3 Filaments 16-18 mic. in diameter; sheaths at first thin, later becoming lamellose, colorless
M. robusta

II Plants living in salt water; heterocysts basal.

- 1 Plant mass densely caespitose; filaments 6-7 mic. in diameter, thickened into a bulb at the base **M. grisea**
- 2 Plant mass loosely caespitose; filaments 7-9 mic. in diameter, flexuous, scarcely thickened at base

M. vitiensis

374. **Microchaete tenuissima** W. and G. S. West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 269. pl. 14. f. 7-11. 1895. De Toni. Syll. Algar. 5: 484. 1907.

West and West. A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 286. 1899.

Plate X. fig. 10.

Filaments 4.4-5.1 mic. in diameter, very slender, somewhat entangled, twisted; sheaths transparent, colorless, wide; trichomes 1-1.8 mic. in diameter; cells elongate, 5-16 mic. in length, the younger cells shorter and wider; heterocysts 2-2.4 mic. in diameter, 3.5-6.5 mic. in length, somewhat quadrate or oblong, intercalary.

West Indies. Amongst *Symplocos cuspidata* on trees, summit of Trois Pitons (4,500 feet). November and December 1892; on rocks, Castle Bruce River (2,000-3,000 feet), Dominica. January and February 1896. (Elliott).

375. **Microchaete tenera** Thuret. Essai Class. Nostochinées. 7. 1875. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 84. 1887. De Toni. Syll. Algar. 5: 482. 1907.

Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 427. 1895. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 194. 1903.

Plate X. fig. 11.

Plant mass small, star-shaped; filaments 6-7 mic. in diameter, 1 mm. in length, curved at the base, slightly flexuous; sheaths thin, close, uniform, colorless; trichomes 5 mic. in diameter; lower cells twice as long as their diameter, upper cells equal in length to their diameter; heterocysts basal, oblong, cylindrical, intercalary.

Alaska. Forming gray tufts on dripping rocks. Walls of Amaknak Cave, Amaknak Island, Bay of Unalaska. (Setchell and Lawson). **Connecticut.** Mixed with various, gelatinous algae, occurring upon dripping rocks near Norwich and New Haven. (Setchell).

376. **Microchaete robusta** Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 194. 1903. De Toni. Syll. Algar. 5: 483. 1907.

Plant mass forming a tuft or star-shaped cluster on water weeds; filaments 16-18 mic. in diameter, elongate and extremely cylindrical, decumbent at the very base, but scarcely thickened; sheaths at first thin, later becoming lamellose, colorless; trichomes 12 mic. in diameter, composed

of cells which are quadrate or slightly longer than broad in the lower portion and shortened to one-third as long as broad in the upper part; cells 6-16 mic. in length; heterocysts basal and intercalary, the former being spherical or nearly so, while the latter are elongated and rectangular; cell contents finely granular, blue-green.

Washington. In ponds of fresh water, near Seattle. (Kincaid).

377. **Microchaete grisea** Thuret. Essai Class. Nostochinées. 7. 1875. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 85. 1887. De Toni. Syll. Algar. 5: 485. 1907.

Collins. Notes on New England Marine Algae IV. Bull. Torr. Bot. Club. 11: 130. 1884. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 4. no. 158. 1896. **Collins.** Preliminary Lists of New England Plants. V. Marine Algae. Rhodora. 2: 42. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905.

Plate X. fig. 12.

Plant mass densely caespitose, tomentose, orbicular, dull green, becoming violet when dried; filaments 6-7 mic. in diameter, 1 mm. in length, curved at the bulbous base, soon becoming erect, densely crowded; sheaths thin, close, continuous, colorless; trichomes 5-6 mic. in diameter; cells shorter than their diameter; heterocysts basal, hemispherical.

Canada. Forming patches on *Fucus evanescens*. Malpeque, Prince Edward Island. (Faull). **Maine.** On *Zostera marina* Goose Creek, Cape Rosier. July 1895. (Collins). **Massachusetts.** On an old pecten shell in company with *Calothrix crustacea*. West Falmouth. (Collins). **Connecticut.** On stranded stump. Seaside Park. November. (Holden).

378. **Microchaete vitiensis** Askenasy in Bornet and Flahault. Tableau synopt. des Nostochacées filamenteuses hétérocystées. 22. 1885. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 85. 1887. De Toni. Syll. Algar. 5: 485. 197.

Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 624. 1905.

Plant mass loosely caespitose, tomentose, short; filaments 7-9 mic. in diameter, scarcely attaining 1 mm. in length, curved and slightly thickened at the base, above slightly tapering, erect, flexuous; sheaths thin, close, colorless; trichomes 5-6 mic. in diameter; cells a little shorter than their diameter; heterocysts basal.

Hawaii. Growing on *Liagora coarctata*. Laysan. 1896-1897. (Schauinsland).

Genus **HORMOTHAMNION** Grunow.

Reise d. Freg. Novara. 31. 1867.

Plant mass formed from filaments growing together in a longitudinal manner, sometimes developing as an expanded layer, sometimes erect, filiform, torn and branched, not surrounded by a common gelatinous tegument; sheaths membranaceous, thin, often diffuent, colorless; trichomes

moniliform; usually many within the sheath; heterocysts intercalary; gonidia not known.

- I Plant mass floccose, entangled; trichomes 9-12 mic. in diameter.

H. solutum

- II Plant mass erect, caespitose, resembling *Symplocia*; trichomes 6-7 mic. in diameter

H. enteromorphoides.

379. *Hormothamnion solutum* Bornet and Grunow in Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 259. 1888. De Toni. Syll. Algar. 5: 486. 1907.

Lemmermann. *Algenfl. Sandwich-Inseln*. Bot. Jahrb. 34: 624. 1905.

Plant mass floccose, entangled, mucous, green or blue-green; filaments 12-15 mic. in diameter, 5-6 mm. in length, soft, flaccid, free or coalesced in numerous fascicles, erect; sheaths membranaceous, firm, colorless; trichomes 9-12 mic. in diameter, constricted at joints; cells disc-shaped, depressed, three or four times shorter than their diameter; heterocysts somewhat quadrate.

Hawaii. (Grunow).

380. *Hormothamnion enteromorphoides* Grunow. Reise seiner Majestät Fregatte Novara um die Erde. Bot. Theil. 1: 31. 1867. Bornet and Thuret. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 7: 260. 1888. De Toni. Syll. Algar. 5: 486. 1907.

Schramm and Mazé. *Essai Class. Algues Guadeloupe*. 29. 1865. (*Sphaerozyga microcoleiformis* Crouan). *Murray*. *Catalogue of the Marine Algae of the West Indian Region*. Journ. of Bot. 27: 261. 1889. *Collins, Holden and Setchell*. *Phyc. Bor.-Am. Fasc. 2. no. 56*. 1895. *Collins*. *The Algae of Jamaica*. Proc. Am. Acad. Arts Sci. 37: 241. 1901. *Vickers*. *Liste des Algues Marines de la Barbade*. Ann. Sci. Nat. Bot. VIII. 1: 55. 1905.

Plate X. fig. 13.

Plant mass at first mucous, confluent, agglutinated, green or blue-green, when older caespitose, formed from simple, erect, soft fascicles, rising from a prostrate base, fastigiately branched; branches tapering at the apices; filaments 7-9 mic. in diameter; sheaths mucous, colorless, delicate; trichomes 6-7 mic. in diameter, 7-10 mic. in length.

Florida. Key West, Tortugas. (Farlow). West Indies. Guadeloupe. (Duchassaing). In tufts from sandy bottom in shallow water. St. Ann's Bay. March 1893; on coral reef, Navy Island, Jamaica. July 1897. (Humphrey). Near Kingston, Jamaica. May 1901. (Duerden). Barbados. (Vickers).

Family III. SCYTONEMACEAE

Filaments branched; false branches formed by the perforation of the sheath by the trichome which thereupon issues as one or two long, flex-

uous branches each developing a sheath of its own; sheaths homogeneous and colorless, or lamellose and yellowish or brownish, firm, tubular; trichomes consisting of a single row of cells, one or more included in a sheath; heterocysts and gonidia variously disposed; reproduction by means of vegetative division, homogones and gonidia.

I Trichomes single within the sheath

- 1 Heterocysts not present; filaments free or forming felt-like masses, branched; false branches often in pairs **Plectonema**

2 Heterocysts present

- (1) False branches usually arising between two heterocysts, single or in pairs; sheaths delicate or very thick, parallel, or more or less diverging towards the apex **Scytonema**
- (2) False branches usually arising in the immediate region of the heterocysts, single; sheaths somewhat thin, flexible, more or less fragile **Tolypothrix**

II Trichomes or filaments several within the sheath.

- 1 Filaments straight, associated in tufts; sheaths thin; trichomes two or more within the sheath; heterocysts basal **Desmonema**
- 2 Filaments several contorted within a common tegument, associated in a gelatinous stratum; trichomes single within the sheath **Diplocolon**

Genus **PLECTONEMA** Thuret.

Essai Class. Nostochinées. 375, 379. 1875.

Filaments free or forming felt-like masses, branched; false branches solitary or in pairs; sheaths firm, colorless or rarely yellowish orange; trichomes frequently constricted at the joints; apex of trichome straight, very rarely tapering; calyptra none.

I Plants large, caespitose; trichomes 3 mic. and more in diameter.

- 1 Plant mass caespitose, rotund, light green; trichomes 5-10 mic. in diameter, here and there constricted at joints

P. tenue

- 2 Plant mass caespitose, indefinite, brownish green; trichomes 11-22 mic. in diameter **P. tomasinianum**

- 3 Plant mass widely expanded, indefinite, blackish, rarely yellowish green; trichomes 28-47 mic. in diameter, not constricted at joints

P. wollei

II Plant mass very thin, not caespitose; trichomes 1-4 mic. in diameter.

- 1 Filaments somewhat flexuous, immersed in dead shells; trichomes 9-1.5 mic. in diameter, not constricted at joints

P. terebrans

- 2 Filaments somewhat straight, growing among various gelatinous algae; trichomes 1-1.5 mic. in diameter **P. nostocorum**

- 3 Filaments usually strongly flexuous, densely entangled in a rose-colored membrane; trichomes 1.2-1.8 mic. in diameter

P. roseolum

- 4 Filaments long, entangled, flexuous, much branched, forming a rose-colored or reddish brown mass adhering to rocks or larger algae; trichomes 1.2-2 mic. in diameter **P. golenkinianum**
- 5 Filaments very long, entangled in dense balls; trichomes 2-2.5 mic. in diameter **P. calothrichoides**
- 6 Filaments long, flexuous, much branched, forming a black or brownish green mass; trichomes 2-3.5 mic. in diameter **P. battersii**

381. **Plectonema tenue** Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 380. 1875. Gomont. Monogr. Oscill. 121. pl. 1. f. 5, 6. 1893. De Toni. Syll. Algar. 5: 492. 1907.

Collins. Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission. 127. 1896.

Plate XI, fig. 1, 2.

Plant mass caespitose, rotund, light green; filaments graceful, elongate, much branched; false branches usually in pairs; sheaths at first colorless and very thin, later becoming thick, and yellowish orange in color; trichomes 5-10 mic. in diameter, here and there constricted at joints, tapering at the apex; apical cell tapering, obtuse conical; cells 2-6 mic. in length; transverse walls not granulated; cell contents finely granular, pale blue-green.

Massachusetts. Spot Pond, Middlesex Fells. (Collins).

382. **Plectonema tomasinianum** (Kuetzing) Bornet. Les Nostocacées hétérocystées du Systema Algarum de C. Agardh (1824) et leur Synonymie actuelle. (1889). Bull. Soc. Bot. de France. 36: 155. 1889. Gomont. Monogr. Oscill. 119. 1893. De Toni. Syll. Algar. 5: 490. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 59. pl. 8. f. 6. 1872. (*Scytonema nägelii* (Kg.) Wood). Rabenhorst. Die Algen Europas. no. 2493. 1877. (*P. mirabile* Thur.). Wille. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 285. 1879. (*Calothrix mirabilis* Ag.). Wittrock and Nordstedt. Algae Aq. Dulc. Exsicc. no. 391. 1880. Wille. Fresh Water Algae. VII. Bull. Torr. Bot. Club. 10: 20. 1883; Fresh-Water Algae U. S. 266. pl. 181. f. 12-15. 1887. Bennett. Plants of Rhode Island. 114. 1888. (*Scytonema natans* Bréb.). Wille and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. (*Calothrix brebissonii* Kg.). Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903.

Plate XI. fig. 3.

Plant mass caespitose, more or less expanded, brownish green or rarely dull blue-green, up to 2 cm. in height; filaments entangled, flexible, usually flexuous, repeatedly branched; false branches often in pairs, issuing in an erect, spreading or oblique manner; sheaths at first thin, colorless, with age

becoming lamellose, yellowish brown and up to 3 mic. in thickness; trichomes 11-22 mic. in diameter, constricted at the joints; apical cell rotund; cells 3-9 mic. in length; transverse walls sometimes granulated; cell contents often filled with coarse granules, blue-green.

Rhode Island. Quidnessett. (Bennett). **New Jersey.** Frequent on stones in ponds or floating. Hammonton. (Wolle). **Pennsylvania.** Forming little dark green mats, growing attached to mosses in large spring that supplies Bellefonte with water. (Wood). In spring. Bethlehem. (Wolle). **Maryland.** Falls of Deep Creek. (Smith). **Ohio.** Plankton. Lake Erie. Put-in-Bay. (Snow). **Minnesota.** Minneapolis. (Wolle).

383. *Plectonema wollei* Farlow. Remarks on some Algae found in the Water Supplies of the City of Boston. Bull. Bussey Inst. 77. 1875. Gomont. Monogr. Oscill. pl. 1. f. 1. 118. 1893. De Toni. Syll. Algar. 5: 489. 1907.

Rabenhorst. Die Algen Europas. no. 2440. 1876. (Lyngbya wollei Farlow). Farlow, Anderson and Eaton. Algae Am. Bor. Exsicc. no. 46. 1877-1889. Wittrock and Nordstedt. Algae Aq. Dulc. Exsicc. no. 279. 1879. Farlow. On some Impurities of Drinking-Water caused by Vegetable Growths. Supp. First Ann. Rep. Mass. State Bd. Health. 131. 1880. Wolle. Fresh-Water Algae U. S. 297. pl. 200. f. 6-8. 1887. Collins. Algae of Middlesex County. 14. 1888. Bennett. Plants of Rhode Island. 114. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 608. 1889. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 2. no. 55. 1895. Tilden. American Algae. Cent. II. no. 177. 1896; List of Fresh-Water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896. Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901. Snow. The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 236. 1905.

Plate XI, fig. 4, 5.

Plant mass caespitose, floating, blackish, rarely yellowish green; filaments woolly, entangled, fragile (in dried specimens), somewhat straight or variously curved, slightly branched; false branches solitary, rarely in pairs, issuing in an oblique manner; sheaths colorless, sometimes yellowish orange, lamellose with age, roughened in outline, up to 10 mic. in thickness; trichomes 28-47 mic. in diameter, not constricted at joints; apical cell rotund; cells 4-9 mic. in length; transverse walls not granulated; cell contents finely granular, blackish or blue-green.

Massachusetts. Attached to stones in rivers. (Wolle). Washed ashore in large quantities. Horn Pond, Woburn; August 1890; Lake Quannapowitt, Wakefield. (Collins). **Rhode Island.** Providence. (Bennett). **Connecticut.** Attached to stones in swift water. Housatonic River, below Great Falls, near New Milford. October 1890. (Holden). **New Jersey.** "The floating mass was fully ten yards long, 2-3 yards wide, a foot or more in thickness, and so densely matted, it was impossible to break through with a row-boat." In pond near Stanhope; Sussex; Lake Hopatcong, Swarts-

wood Pond. (Wolle). **Pennsylvania.** Bethlehem. (Wolle). **Florida.** (Wolle). **South Carolina.** Strouds. August, October 1896. (Green). **Ohio.** Plankton. Lake Erie, Put-in-Bay. (Snow). **Minnesota.** Forming large masses, dark, nearly black in color, on surface of stagnant lake. Long Lake, Hennepin County. September 1895. (Shaver and Tilden). **Central America.** Nicaragua. (Agardh). **West Indies.** In rapid current of stream. "Roaring River," St. Ann's, Jamaica. March 1893. (Humphrey). Morant Bay. August 1894. (Pease and Butler).

384. *Plectonema terebrans* Bornet and Flahault. Sur quelques Plantes vivant dans le Test Calcaire des Mollusques. Bull. Soc. Bot. de France. 36: CLXIII. pl. 10. f. 5, 6. 1889. Gomont. Monogr. Oscill. 123. 1893. De Toni. Syll. Algar. 5: 497. 1907.

Collins. Some Perforating and other Algae on Fresh-Water Shells. Erythea. 5: 95. 1897. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 306. 1897. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 28. no. 1357. 1907.

Plate XI. fig. 6.

Filaments slender, elongate, flexuous, branched; false branches often solitary; sheaths very thin, colorless, cylindrical; trichomes .9-1.5 mic. in diameter, not constricted at joints; cells 2-6 mic. in length; apical cell rotund; transverse walls marked by two refringent granules; cell contents pale blue-green.

Maine. In live shells of *Littorina*, in company with *Hyella caespitosa*. Cape Rosier. July 1901. (Collins). **Rhode Island.** (Collins). **Connecticut.** In *Unio* shells. Twin Lakes, Salisbury, Litchfield County. August 1895. (Setchell and Holden). "Very abundant all through the shells, and when the latter were decalcified, formed a dense mat which made it rather difficult to distinguish the other algae that grew in company with it."—Collins. In marine shells with other algae. Harbor. September, October. (Holden).

385. *Plectonema nostocorum* Bornet in Bornet and Thuret. Notes Algologiques. 2: 137. 1880. Gomont. Monogr. Oscill. 122. pl. 1. f. 11. 1893. De Toni. Syll. Algar. 5: 495. 1907.

Collins. Notes on Algae.—III. Rhodora. 3: 133. 1901; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 240. 1901; Algae of the Flume. Rhodora. 6: 230. 1904. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1164. 1904. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 624. 1905.

Plate XI. fig. 7.

Filaments graceful, elongate, somewhat straight, at first much branched, later sparingly branched; false branches solitary or in pairs; sheaths colorless, very thin, cylindrical; trichomes 1-1.5 mic. in diameter, constricted at

joints; apical cell rotund; cells 2-2.5 mic. in length; transverse walls not granulated.

Maine. In the gelatine of a small *Nostoc*, growing in a watering trough by the side of the road from Seal Harbor to Jordan Pond, Mount Desert. July 1900. (Collins). **New Hampshire.** In a gelatinous mass on a wet cliff. Wanalancet Falls, Tamworth. August 1903; with other algae in masses of translucent gelatine, on walls of the "Flume," September 1904. (Collins). **West Indies.** Among *Gloeocapsa quaternata*. Bath, Jamaica. July 1900. (Pease and Butler). **Hawaii.** In hot water. Kilauea, Hawaii. (Schauinsland).

386. *Plectonema roseolum* (Richter) Gomont. Monogr. Oscill. 122. pl. 1. f. 9, 10. 1893. De Toni. Syll. Algar. 5: 494. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 188. 1903.

Plate XI. fig. 8.

Plant mass gelatinous, rose-colored, when dried becoming papery, adhering to the paper; filaments densely entangled, strongly tortuous and abundantly branched, sometimes less tortuous and sparingly branched; false branches solitary or in pairs; sheaths colorless, usually thick, firm, irregular in outline; trichomes 1.2-1.8 mic. in diameter, not constricted at joints; apical cell rotund; transverse walls marked by two protoplasmic granules; cell contents very pale rose-color.

Alaska. On dripping rocks. West shore of Amaknak Island. Bay of Unalaska. (Setchell and Lawson).

387. *Plectonema golenkinianum* Gomont. Sur quelques Oscillariées Nouvelles. Bull. Soc. Bot. de France. 46: 35. pl. 1. f. 11. 1899. De Toni. Syll. Algar. 5: 494. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 13. no. 603. 1899. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900; Notes on Algae.—VI. Rhodora. 5: 233. 1903.

Plate XI. fig. 9.

Forming a rose-colored or reddish brown mass, adhering to rocks or larger algae; filaments entangled, elongate, flexuous, abundantly and repeatedly branched; false branches spreading, elongate, in pairs, more slender than the primary filament; sheaths colorless, somewhat thick; trichomes 1.2-2 mic. in diameter, constricted at joints; apical cell rotund; cells shorter than their diameter; cell contents homogeneous, rose-colored.

Maine. Forming a reddish brown coating on wet cliffs, and especially in "grottoes." Eagle Island, Penobscot Bay. July 1893. (Collins).

388. *Plectonema calothrichoides* Gomont. Sur quelques Oscillariées Nouvelles. Bull. Soc. Bot. de France. 46: 30. pl. 1. f. 6-10. 1899. De Toni. Syll. Algar. 5: 496. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 13. no. 604. 1899.

Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900.

Plate XI. fig. 10.

In a crust formed by various blue-green algae; filaments scarcely elongate, entangled in dense balls, radial because of pressure, strongly tortuous, tapering at the apices, branched; false branches in pairs, spreading, often parallel; sheaths thick and orange brown in the middle portion of the filament, gradually becoming thinner and faded at the ends; trichomes 2-2.5 mic. in diameter, constricted at joints; apical cell rotund; cells shorter than their diameter, cell contents pale blue-green.

Massachusetts. Marblehead. January 1889; with other algae, on rocks near high water mark, Nahant, June 1889. (Collins).

389. *Plectonema battersii* Gomont. Sur quelques Oscillariées Nouvelles. Bull. Soc. Bot. de France. 46: 36. 1899. De Toni. Syll. Algar. 5: 495. 1907.

Collins. An Algologist's Vacation in Eastern Maine. Rhodora. 4: 177. 1902; Notes on Algae.—VI. Rhodora. 5: 233. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 22. no. 1060. 1903.

Plant mass blackish or brownish green; filaments elongate, flexuous, abundantly and repeatedly branched; false branches usually in pairs, more slender than the main filaments; sheaths colorless, somewhat thick in the main filaments; trichomes 2-3.5 mic. in diameter, constricted at joints, with somewhat tapering apices; apical cell rotund; cells shorter than their diameter; cell contents homogeneous, pale blue-green.

Maine. In a runway on rocks from upper pools. Brownie Island, Jonesport. July 1902; Harpswell. (Collins). **Massachusetts.** Marblehead Neck. August 1902. (Collins).

Genus **SCYTONEMA** Agardh. Syst. Algar. 26. 1824.

Filaments branched; false branches usually arising between two heterocysts, solitary or in pairs, formed by the lateral perforation of the sheath by the trichome; trichomes single within the sheath, straight; hormogones terminal, solitary; gonidia spherical or oval, observed in a few species; wall of gonidium thin, smooth.

I Sheaths homogeneous or formed of parallel layers.

1 Plants living in fresh water

- | | |
|---|------------------------|
| (1) Filaments 5-8 mic. in diameter | <i>S. conchophilum</i> |
| (2) Filaments 12-16 mic. in diameter | <i>S. arcangelii</i> |
| (3) Filaments 18-24 mic. in diameter | <i>S. coactile</i> |
| (4) Filaments about 30 mic. in diameter | <i>S. rivulare</i> |
| (5) Filaments 36 mic. in diameter | <i>S. occidentale</i> |
| (6) Filaments 16-36 mic. in diameter | <i>S. crispum</i> |

2 Plants living in warm water

- | | |
|-----------------------------------|---------------------|
| (1) Filaments 16 mic. in diameter | <i>S. caldarium</i> |
|-----------------------------------|---------------------|

- (2) Filaments 25 mic. in diameter *S. azureum*
- 3 Plants living on soil, rocks, or bark, not submerged
 - (1) Filaments 7-15 mic. in diameter *S. hofmanni*
 - (2) Filaments 9-15 mic. in diameter *S. varium*
 - (3) Filaments 12-15 mic. in diameter *S. javanicum*
 - (4) Filaments 10-18 mic. in diameter *S. ocellatum*
 - (5) Filaments up to 20 mic. in diameter *S. intertextum*
 - (6) Filaments 15-20 mic. in diameter *S. austinii*
 - (7) Filaments 15-21 mic. in diameter; cells compressed *S. millei*
 - (8) Filaments 15-21 mic. in diameter; cells somewhat quadrate or elongate *S. guyanense*
 - (9) Filaments 19-24 mic. in diameter *S. amplum*
 - (10) Filaments 20-25 mic. in diameter *S. wolleanum*
 - (11) Filaments 16-30 mic. in diameter *S. stuposum*
- II Sheaths lamellose, with diverging layers; plants usually living on soil or rocks, not submerged.
 - 1 Filaments 10-15 mic. in diameter *S. tolypotrichoides*
 - 2 Filaments 12-18 mic. in diameter *S. flavo-viride*
 - 3 Filaments 15-21 mic. in diameter *S. mirabile*
 - 4 Filaments 18-36 mic. in diameter *S. myochrous*
 - 5 Filaments 40-75 mic. in diameter *S. badium*
- III Sheaths thick, lamellose, forming wings or membranaceous expansions (ocreae); branches in basal portion of filament issuing in pairs, those in the upper portion solitary.
 - 1 Plants living in water
 - (1) Plants living in salt water; filaments 28-50 mic. in diameter *S. fuliginosum*
 - (2) Plants living in fresh water, on dripping rocks or submerged *S. alatum*
 - 2 Plants living on damp rocks or on bark
 - (1) Filaments 12-16 mic. in diameter *S. junipericolum*
 - (2) Filaments 15-30 mic. in diameter *S. crustaceum*
 - (3) Filaments 24-40 mic. in diameter *S. densum*

Species not well understood

S. bornetianum
S. dubium
S. hirtulum
S. immersum
S. polymorphum
S. rubrum
S. simplex

390. *Scytonema conchophilum* Humphrey in Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 2. no. 52. 1895.

Plant mass having the form of gray, postular roughenings on shells; filaments 5-8 mic. in diameter, irregularly branched; false branches single or in pairs, with rounded apices; sheaths rather thin, deep yellow, homogeneous, when old rough on the outside, colorless and thin at growing tips; trichomes 2.7-4.5 mic. in diameter; cells two-thirds to twice as long as broad; heterocysts 5 mic. in diameter, spherical or slightly elongated, rarely two or three together, intercalary; cell contents pale bluish green.

West Indies. On old conch shell, *Mastigocoleus testarum* occurring on inside of same shell. Port Antonio. March 1893; Kingston, Jamaica. June 1897. (Humphrey).

391. *Scytonema arcangelii* Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 92. 1887. De Toni. Syll. Algar. 5: 502. 1907.

Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901.

Plant mass cushion-shaped, 3-4 mm. in height, expanded, gray or greenish; filaments 12-16 mic. in diameter, entangled in fascicles; false branches long, flexuous; sheaths membranaceous, thin, colorless; trichomes 10-14 mic. in diameter; cells disc-shaped or somewhat quadrate; heterocysts somewhat quadrate, colorless or yellowish.

West Indies. On moist rocks by spring. Castleton, Jamaica. April 1893. (Humphrey).

392. *Scytonema coactile* Montagne in Kuetzing. Spec. Algar. 305. 1849. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 90. 1887. De Toni. Syll. Algar. 5: 501. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 32. 1865. Mazé and Schramm. Essai Class. Algues Guadeloupe. 34-36. 1870-1877. (*S. coactile* radians Crouan, *S. elegans antillarum* Crouan, *Tolypothrix guadelupensis* Crouan). Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

Plant mass caespitose, woolly, silky, radiately expanded, green or blue-green, up to 15 cm. in diameter; filaments 18-24 mic. in diameter, 4 cm. and more in length; false branches long, erect, spreading; sheaths firm, membranaceous, colorless or yellowish; trichomes 12-18 mic. in diameter; cells somewhat quadrate or longer than the diameter; heterocysts somewhat rare, somewhat quadrate.

West Indies. At first attached, finally floating free in stagnant water (Perrottet, Montagne).

393. *Scytonema rivulare* Borzi. Morfologia e Biologia delle Alge Ficomacee. Nuovo Giorn. Bot. Ital. 11: 373. 1879. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 91. 1887. De Toni. Syll. Algar. 5: 501. 1907.

Tilden. American Algae. Cent. V. no. 479. 1901; Collection of Algae from the Hawaiian Islands. Haw. Almanac and Annual for 1902. 111. 1901.

Plate XI. fig. 11, 12.

Plant mass widely expanded, woolly, blackish, verging towards red; filaments about 30 mic. in diameter, sparingly branched, variously flexuous or curved; sheaths firm, close, homogeneous, "glassy," up to 5 mic. in thickness; cells quadrate or shorter than wide; heterocysts having the form and size of the vegetative cells, orange or yellowish; gonidia spherical, blackish or lead-colored; wall of gonidium firm, smooth; cell contents distinctly granular, lead-colored becoming purple.

Hawaii. Forming dark brownish or purplish red cushions on stones in mountain stream. Kaliwaa stream, Makao, Koolauloa, Oahu. June 1900. (Tilden).

394. *Scytonema occidentale* Setchell. Notes on Cyanophyceae.—III. Erythraea. 7: 49. 1899. De Toni. Syll. Algar. 5: 503. 1907.

Plate XI. fig. 13, 14.

Forming tufts of a somewhat rigid consistency and of a black color; filaments 36 mic. in diameter, decumbent at base, branched; false branches 21-27 mic. in diameter, usually in pairs, erect, flexuous, free or included for a longer or shorter distance within a common sheath; sheaths thick, gelatinous, roughened, made up of parallel layers; trichomes 18-30 mic. in diameter; cells 9-12 mic. in length, those in the hormogones much shorter, 3 mic. in length; cell contents grayish violet.

California. Growing upon bare smooth rock bed of La Jota Creek, just above the Falls, on Howell Mt., near St. Helena, Napa County. (Setchell).

395. *Scytonema crispum* (Agardh) Bornet. Les Nostocacées hétérocystées du Systema Algarum de C. Agardh (1824) et leur Synonymie actuelle (1889). Bull. Soc. Bot. de France. 36: 156. 1889. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 89. 1887. (*S. cincinnatum* Thur.) De Toni. Syll. Algar. 5: 498. 1907.

Dickie. Fresh-water Algae. Brown's Florula Discoana. Contributions to the Phyto-Geography of Greenland within the Parallels of 68° and 70° North Latitude. Trans. Bot. Soc. Edinburgh. 9: 464. 1868. (*L. cincinnata* Kg.) **Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 183. 1877. **Nordstedt.** De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 6. 1878. **Wolle.** Fresh Water Algae. V. Bull. Torr. Bot. Club. 8: 38. 1881; Fresh-Water Algae U. S. 254. pl. 185. f. 8-10. 1887. **Johnson and Atwell.** Fresh Water Algae. Northwestern University. Report Dept. Nat. Hist. 20. 1890. **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 428. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 2. no. 60. 1895; Fasc. 14. no. 655. 1900. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 14. 1901. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901. **Tilden.** American Algae. Cent. V. no. 480. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 112. 1901. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Lemmer-**

mann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 624. 1905. Tilden.
American Algae. Cent. VII. Fasc. I. no. 632. 1909.

Plate XI. fig. 15.

Plant mass caespitose, entangled, woolly, green, becoming brown or olive; filaments 16-36 mic. in diameter, 3 cm. and more in length, curled, branched; sheaths firm, membranaceous, colorless, rarely becoming brownish; trichomes 14-30 mic. in diameter; cells three times shorter than their diameter; heterocysts depressed or quadrate, sometimes numerous, sometimes almost none.

Greenland. Abundant in "Lyngemarken Spring, September." (Dickie).
Rhode Island. In abundance near Providence. (Osterhout). **Connecticut.** Near Lanesville; on rock below Factory Pond; ditch at North Haven. September, November. (Holden). Forming extensive dark green woolly masses in stagnant water. North Haven. October 1891. (Setchell). **Pennsylvania.** In a pond near Bethlehem. (Wolle). **Florida.** (Coe). **Illinois.** Lakeside, Cook County. May (Johnson and Atwell). **Minnesota.** Lily Lake, near Stillwater, Washington County. August 1908. (Tilden). **Nebraska.** In ponds. Nebraska City. (Bessey). **Colorado.** (Brandegge). **West Indies.** In reservoir. Botanic Garden, Castleton, Jamaica; on sides of trough, Constant Spring; in basin, Kingston. April 1893. (Humphrey). **Hawaii.** In ponds. Nuanu, Oahu. (Berggren). Floating in mats on surface of stagnant water among roots of Water Hyacinth, on beach. Meheiwa, Makao, Koolauloa, Oahu. June 1900. (Tilden).

"The filaments vary very much. Sometimes both branches and heterocysts are rare and the species looks very much like a *Lyngbya*, very often the scanty branches occur single and adjacent to a heterocyst and it resembles greatly a *Tolypothrix*, while the geminate branches midway between two heterocysts, characteristic of *Scytonema* are generally found only after long and careful search."—Setchell.

396. *Scytonema caldarium* Setchell. Notes on Cyanophyceae.—III. Erythea. 7: 48. pl. 3. f. 3. 1899. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 559. 1899.

Plate XII. fig. 1.

Plant mass forming more or less extended tufts; filaments 16 mic. in diameter, decumbent or even horizontal at base, more or less entangled, branched; false branches in pairs, erect, twisted together into Symplocalike tufts, 8-15 mm. high; erect filaments 12-16 mic. in diameter, seldom or only singly branched; sheaths firm, lamellose, with parallel layers, colorless, soon becoming a deep yellowish brown; trichomes 4-8 mic. in diameter; cells 3-12 mic. in length; heterocysts discoid to quadrate in the younger portions of the filaments, cylindrical in older portions, colorless; cell contents uniformly coarsely granular, olive or yellowish green.

California. Growing on cooler portions of the rocks from which the hot water drips. Temperature of the tufts 27° C. Waterman Hot Springs, near San Bernadino. April 1897. (Parish).

397. *Scytonema azureum* Tilden. American Algae. Cent. VII. Fasc. 1. no. 630. 1909.

Plate XII. fig. 2, 3.

Filaments 25 mic. in diameter, flexuous, sparingly branched; false branches usually in pairs, occasionally originating at the heterocysts as in *Tolypothrix*; sheaths narrow, straight, smooth; trichomes 17 mic. in diameter, often constricted at joints; cells quadrate or shorter than broad; heterocysts somewhat spherical or quadrate, yellowish green; cell contents more or less deep bluish purple (cyaneus, azureus) in color.

Hawaii. With other algae forming a layer covering rocks on bottom and sides of basin of "warm spring." Temperature at 7 a. m. 31° C. Puna, Hawaii. July 1900. (Tilden).

398. *Scytonema hofmanni* Agardh. Synopsis Algar. Sueciae. 117. 1817. Bor-net and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 97. 1887. De Toni. Syll. Algar. 5: 513. 1907.

Wood. Prodromus of a Study of the Fresh-Water Algae of Eastern North America. 130. 1869. **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 32. 1870-1877. (*S. julianum* Menegh., *S. cinereum* Crouan). **Wood.** Contr. Hist. Fresh-Water Algae North America. (*S. cortex* Wood). 64. 1872. **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. (*Symphysiphon hofmanni* Kg.). **Wolle.** Fresh-Water Algae U. S. 262. pl. 189. f. 3. 1887. **Moebius.** Ueber einige in Portorico gesammelte Süßwasser- und Luft-Algen. Hedwigia. 27: 245. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **Bessey.** Additions to the Reported Flora of Nebraska, made during 1893. Bot. Surv. Nebraska. 5. 1894. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 24. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 9. no. 404. 1898. **West and West.** A Further Contribution to the Fresh-water Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 287. 1898-1900. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 17. no. 803. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 195. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 26. no. 1258. 1905.

Plate XII. fig. 4.

Plant mass cushion-shaped, widely expanded, 1-3 mm. in thickness, blackish or blue-green, sometimes impregnated with calcium carbonate, then purple or green or bluish gray; filaments 7-15 mic. in diameter, coalesced in vertical fascicles; false branches aggregated; sheaths firm, membranaceous; trichomes 5-10 mic. in diameter, olive or blue-green; cells unequal in length; heterocysts oblong.

Alaska. On dripping rocks. Iliuliuk, Unalaska. (Setchell and Lawson). **New Hampshire.** On rocks near the brook. Tuckerman's Ravine, near Shel-

burne. (Farlow). **Massachusetts.** Newton. (Farlow). On shaded rocks. High Ledge, Melrose. April 1892. (Collins). **Connecticut.** On old stumps. Shore of upper Twin Lake, Salisbury. October. (Holden). **New Jersey.** On moist earth, wood and rocks. (Wolle). **Nebraska.** On damp wood, in greenhouses. State University, Lincoln. (Bessey, Saunders). **California.** On rocks. North side of Bolinas Ridge, Marin County. June 1896. (Setchell). **West Indies.** Forming violet-colored masses among mosses on limestone rocks in mountains near Utuado, Porto Rico. (Moebius). On steps of Court House, Port Antonio. April 1893; on leaves of trees, Bath, Jamaica. (Humphrey). Head of Castle Bruce River, Dominica. January and February 1896. (Elliott).

Forma **brunnea** Wolle. Fresh-Water Algae U. S. 258. 1887; Fresh Water Algae. Bull. Torr. Bot. Club. 6: 284. 1879. (S. cortex bruneum Wolle). De Toni. l. c. 515.

Plant mass dark brown; filaments covered with apparently "sub-spherical, resinous cells."

South Carolina. (Ravenel). **Florida.** (Ravenel, Smith, Austin).

Var. **symplocoides** (Reinsch) Bornet and Flahault. l. c. 99. De Toni. l. c. 515.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 36. 1870-1877. (*Calothrix conferta* Crouan).

Sheaths colorless; cell contents pale blue-green.

West Indies. (Mazé).

Var. **calcicolum** Hansgirg. Physiologische und Algologische Mittheilungen. pl. 3. f. 35. 1890; Prodrömus der Algenflora von Böhmen. 2: 33. 1892. De Toni. l. c. 516.

Plant mass smooth, brown or black, rarely almost soft, gelatinous, often expanded; filaments 6-12 mic. in diameter, more or less branched, curved, often associated in dense floccose masses; false branches somewhat more slender, single or in pairs, approximate, usually issuing between two heterocysts, erect; sheaths close, somewhat thickened with age, yellow or yellowish orange, rarely almost colorless; trichomes 4-6 mic. in diameter; cells almost inconspicuous, somewhat quadrate or twice as short as wide, heterocysts somewhat quadrate, single or in pairs, a little shorter or longer than their diameter; cell contents granular, dull blue-green, green, olive or yellowish.

South Carolina. (Ravenel). **Florida.** (Smith, Austin, Ravenel).

399. **Scytonema varium** Kuetzing. Spec. Algar. 307. 1849. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 97. 1887. De Toni. Syll. Algar. 5: 512. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 34. 1870-1877. **Wolle.** Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 139. 1877. (S. chrysochlorum Kg.); Fresh-Water Algae U. S. 253. 1887. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ.

Calif. Pub. Bot. 1: 195. 1903. **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 625. 1905.

Plate XII. fig. 5.

Plant mass 2-3 mm. in height, cushion-shaped, bluish-green or brownish; filaments 9-15 mic. in diameter, tortuous, entangled; sheaths gelatinous, below colorless, pellucid, in upper portions yellowish; trichomes 5-7 mic. in diameter; cells somewhat quadrate, scarcely distinct; heterocysts somewhat quadrate or longer than the diameter, colorless; cell contents densely granular, blue-green or yellowish.

Alaska. On rocks moistened by spray from a waterfall. Near Juneau. (Saunders). **Canada.** Shaded rocks. Niagara. (Wolle). **Florida.** Anastatia Island, St. Augustine. (Wolle). **Hawaii.** (Schauinsland).

400. **Scytonema javanicum** (Kuetzing) Bornet in Bornet and Flahault. Notes Algologiques. 148, 1880. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 1887. De Toni. Syll. Algar. 5: 506. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 269. pl. 14. f. 12-15. 1895. **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 428. 1895. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901.

Plate XII. fig. 6.

Plant mass cushion-shaped, 2-4 mm. in thickness, deep blue-green or reddish; filaments 12-15 mic. in diameter, coalesced in vertical fascicles; false branches long, flexuous, aggregated; sheaths firm, thin, colorless, becoming yellowish; trichomes 9-12 mic. in diameter; cells compressed or quadrate; heterocysts somewhat quadrate; cell contents green becoming brown or violet.

Massachusetts. Growing on trunks of trees in Middlesex Fells, Melrose. (Setchell). **West Indies.** On lime trees. Shanford Estate; Anguilla; on walls, Roseau, Dominica, November, December 1892. (Elliott). On flower pot in garden. Castleton, Jamaica. April 1893. (Humphrey).

Var. **hawaiiense** Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 624. pl. 7. f. 6-8. 1905. De Toni. l. c. 507.

Plate XII. fig. 7.

Plant mass cushion-shaped, dark blue-green; filaments 9.5-11 mic. in diameter, coalesced into vertical fascicles; sheaths firm, thin, always colorless; trichomes 5.5-8 mic. in diameter; cells 5.5-14 mic. in length, cylindrical, sometimes quadrate (younger cells compressed); heterocysts 7-9.5 mic. in diameter, 9.5-14 mic. in length, usually cylindrical, rarely somewhat quadrate, sometimes yellowish; cell contents homogeneous, pale blue-green, the cells in younger branches being filled with reddish bodies (gas vacuoles).

Hawaii. Among mosses. Crater of Kilauea, Hawaii. (Schauinsland).

401. **Scytonema ocellatum** Lyngbye. Hydrophytologia Danica. 97. pl. 28 A.

1819. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 95. 1887. De Toni. Syll. Algar. 5: 509. 1907.
- Mazé and Schramm.** Essai Class. Algues Guadeloupe. 33. 1870-1877. (*S. torridum* Agardh, *S. parietinum* Crouan). **Wolle.** Fresh-Water Algae U. S. 258. pl. 188. f. 1-4, 10-14. 1887. (*S. cinereum* Menegh.). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 24. pl. 2. f. 24. 1894. **Bessey.** Additions to the Reported Flora of Nebraska made during 1893. Bot. Surv. Nebraska. 3: 5. 1894. **Setchell.** Notes on Cyanophyceae.—I. *Erythea*. 4: 88. 1896. **Wittrock, Nordstedt, and Lagerheim.** Algae Aq. Dulc. Exsicc. no. 1322. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 5. no. 210. 1896; Fasc. 15. no. 711. 1900. **Bessey, Pound and Clements.** Additions to the Reported Flora of the State. Bot. Surv. Nebraska. 5: 14. 1901. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901; Algae of the Flume. *Rhodora*. 6: 230. 1904; Phycological Notes on the late Isaac Holden.—II. *Rhodora*. 7. 237. 1905. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 625. 1905.

Plate XII. fig. 8.

Plant mass cushion-shaped, black or gray becoming bluish; filaments 10-18 mic. in diameter, up to 3 mm. in length, entangled, branched; false branches short; sheaths firm, becoming brownish; trichomes 6-14 mic. in diameter, cells shorter than the diameter or quadrate, heterocysts somewhat quadrate, yellowish; cell contents olive green.

New Hampshire. One of the three species composing the brown coating on the wall of the "Flume." September 1904. (Collins). **Massachusetts.** Forming a dark brown felt upon rocks just above the surface of the water. Massapoag Brook, at Sharon. April 1891. (Setchell). **Connecticut.** On dripping rocks. Sage's Ravine, Salisbury. August. (Holden). **New York.** (Wolle). **New Jersey.** On moist rocks. Bergen, Godwinville. (Austin). **Pennsylvania.** On moist rocks and shaded walls. (Wolle). **Florida.** (Wolle). **Nebraska.** On flower pots in greenhouse. University, Lincoln. (Bessey, Saunders). **Bermudas.** On sand dunes. Paget. January 1900. (Farlow). **West Indies.** On bark of trees. Near Constant Spring, Kingston, Jamaica. December 1892. (Lagerheim). On old palm stems. Castleton, Jamaica. April 1893. (Humphrey). **Hawaii.** (Berggren, Schauinsland).

402. *Scytonema intertextum* (Kuetzing) Rabenhorst. Fl. Eur. Algar. 2: 263. 1865. De Toni. Syll. Algar. 5: 511. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 284. 1879; Fresh-Water Algae U. S. 258. pl. 186. f. 10-17. 1887.

Plate XII. fig. 9.

Plant mass more or less thick, cushion-shaped, compact, dark brown or olive; filaments up to 20 mic. in diameter, ascending; false branches fasciculate, flexuously curved, densely entangled; sheaths somewhat thick, sometimes a little swollen, distinctly lamellose, yellowish or flesh-colored,

rarely brownish, the external layers sometimes diffuent into colorless fibrils; trichomes 12-16 mic. in diameter, here and there irregularly constricted at joints; cells equal to or a little longer than their diameter; heterocysts oblong or somewhat spherical, very pale brown in color, solitary or in pairs at the base of the false branches; cell contents granular.

Florida. On old wood. (Smith).

403. *Scytonema austinii* Wood. Contr. Hist. Fresh-Water Algae North America. 58. 1874. De Toni. Syll. Algar. 5: 511. 1907.

Wolle. Fresh-Water Algae U. S. 261. pl. 189. f. 5. 1887. (*Symphysiphon austinii* Wood). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889.

Plant mass cushion-shaped and somewhat turfy, brown or black; filaments 15-20 mic. in diameter, ascending, mostly unbranched, curved; sheaths reddish or yellowish brown at the apex, colorless and transparent, firm, indistinctly lamellose, with rough surface; trichomes 4-10 mic. in diameter, blue-green or dark-colored, often very much thickened at the ends; cells shorter or longer than their diameter; heterocysts short, cylindrical, somewhat quadrate or spherical, sometimes strongly compressed and much shorter than broad.

New Jersey. Forming a sort of miniature turfy cushion upon the rocks. Little Falls. (Austin). Pennsylvania. On rocks. (Wolle).

404. *Scytonema millei* Bornet in Bornet and Thuret. Notes Algologiques. 147. 1880. Bornet and Flahault. Ann. Sci. Nat. Bot. VII. 5: 93. 1887. De Toni. Syll. Algar. 5: 505. 1907.

Hohenacker. Algae Marinae Siccatae. no. 458. 1862. (*S. lepieurii* Kg.). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 29. no. 1405. 1907.

Plant mass cushion-shaped, woolly, widely expanded, 1-5 mm. thick, dark green, becoming brown; filaments 15-21 mic. in diameter, flexuous, entangled, branched; false branches erect, spreading; sheaths firm, brownish; trichomes 10-15 mic. in diameter; cells compressed; heterocysts compressed, brown, shorter than the diameter of the trichome.

West Indies. On earth. St. Thomas. (Hohenacker). On earth and rocks. Mavis Bank Road, Jamaica. June 1906. (Lewis).

405. *Scytonema guyanense* (Montagne) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 1887. De Toni. Syll. Algar. 5: 506. 1907.

Montagne. Histoire de l'Île de Cuba. 10. pl. 2. f. 2. 1838. (*S. byssoides corticale* Mont.). Wood. Prodr. of a Study of the Fresh-Water Algae of Eastern North America. Proc. Am. Phil. Soc. 11: 130. 1869. Mazé and Schramm. Essai Class. Algues Guadeloupe. 33: 1870-77. (*Calothrix indica* Crouan). Wood. Contr. Hist. Fresh-Water Algae North America. 64. pl. 5. f. 4. 1872. (*S. ravenelii* Wood). Wood. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 139. 1877. (*Symphysiphon wollei* Born.). Nordstedt. De Algis Aquae Dulcis et de Characeis ex insulis Sandvicensibus a Sv. Berggren 1875 reportatis. (S.

pulvinatum Nordst.). **Wolle.** Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. (*Mastigonema velutinum* Wolle); Fresh-Water Algae U. S. 257. pl. 186. f. 1-6. 1887. (*S. cortex ravenelii* Wolle). **Collins.** Algae of Middlesex County. 13. 1888. **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 624. 1905.

Plant mass dense, cushion-shaped, 1-2 mm. in thickness, widely expanded, blackish green; filaments 15-21 mic. in diameter, coalesced in vertical fascicles; false branches long, flexuous, aggregated; sheaths firm, membranaceous, lamellose, yellowish brown; trichomes 10-16 mic. in diameter; cells somewhat quadrate or elongate; cell contents olive green.

Massachusetts. In a greenhouse. Newton. (Farlow). **New Jersey.** Forming an extended olive green stratum, a little above the water level, on the plank sides of a neglected basin of sea water. Perth Amboy. July 1878. (Wolle). **Pennsylvania.** On calcareous rocks. (Wolle). **South Carolina.** Forming little turfy spots of a greenish color on bark. Growing on twigs of a *Celtis* and on bark of a willow. (Ravenel). **Florida.** On trunks of various trees. (Smith). **Hawaii.** On volcanic gravel, Oahu. (Berggren, Schauinsland).

406. *Scytonema amplum* West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 270. pl. 16. f. 14-16. 1895; A Further Contribution to the Freshwater Algae of the West Indies. 1. c. 34: 287. 1900. De Toni. Syll. Algar. 5: 512. 1907.

Plate XII. fig. 10, 11.

Plant mass small, woolly, 3-5 mm. in diameter, brownish; filaments 19-24 mic. in diameter, densely entangled; false branches 13.5-16 mic. in diameter, rare, usually in pairs but sometimes single, more slender than the main filament; sheaths very wide, formed of parallel layers, in outer portions gelatinous, colorless or somewhat yellowish, in the interior abruptly yellowish or brownish; trichomes 3.5-4 mic. in diameter, narrow; cells up to six times longer than the diameter; heterocysts oblong, several times longer than their diameter; cell contents yellowish green.

West Indies. On trees. Summit of Trois Pitons (4,500 feet). November, December. 1892; on rocks, Castle Bruce River (2,000-3,000 feet), Dominica. January, February 1896. (Elliott).

407. *Scytonema wolleanum* De Toni. Syll. Algar. 5: 513. 1907. Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 284. 1879; Fresh-Water Algae U. S. 255. pl. 187. f. 1-3. 1887. (*S. mirabile* Wolle).

Plate XII. fig. 12.

Plant mass more or less widely expanded, olive becoming brownish; filaments 20-25 mic. in diameter, strongly curved and flexuous; false branches 12.5-15 mic. in diameter, numerous, usually in pairs, adhering usually without separation of the trichome at the end; sheaths firm, smooth, olive or yellowish, rarely nearly colorless; trichomes often somewhat moniliform; cells two to three times shorter than their diameter.

Florida. On bark of Cypress trees. (Ravenel).

408. *Scytonema stuposum* (Kuetzing) Bornet in Bornet and Thuret. Notes

Algologiques. 146. 1880. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 92. 1887. De Toni. Syll. Algar. 5: 503. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 34. 1870-1877. (*S. cyanescens* Crouan).

Plate XII. fig. 13, 14.

Plant mass cushion-shaped, woolly, widely expanded, blackish violet or becoming reddish; filaments 16-30 mic. in diameter, 5-10 mm. long, free, branched; false branches approximate, solitary or in pairs; sheaths thick, gelatinous; trichomes 12-18 mic. in diameter; cells somewhat quadrate or two or three times shorter than their diameter; heterocysts equaling the cells in diameter; cell contents olive or violet.

West Indies. (Mazé).

409. **Scytonema tolypotrichoides** Kuetzing. Spec. Algar. 307. 1849. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 100. 1887. De Toni. Syll. Algar. 5: 516. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 61. pl. 6. f. 2. 1872. (*S. calotrichoides* Wood). **Wolle.** Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 139. 1877; Fresh-Water Algae U. S. 250. pl. 182. f. 4-11. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **Setchell.** Notes on Cyanophyceae.—II. Erythea. 4: 192. 1896.

Plate XIII. fig. 1.

Plant mass caespitose, floating, spherical, one cm. in diameter, brown or green in color, filaments 10-15 mic. in diameter, 5-6 mm. long, radiating from the center, repeatedly branched; sheaths colorless, becoming orange brown, lamellose; the outer layers often colorless; trichomes 8-12 mic. in diameter; cells somewhat quadrate or oblong, scarcely distinct; heterocysts varied, some short, some long, rose-colored; cell contents densely granular, olive or yellowish.

New York. In gelatinous masses on dripping rocks. Niagara Falls; on wet or moist earth on the banks of rivers. (Wolle). **New Jersey.** Frequent on wet rocks. (Wolle). **South Carolina.** In wet, boggy places, on rotten pine boards. September 1869. (Ravenel).

410. **Scytonema flavo-viride** (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 101. 1887. De Toni. Syll. Algar. 5: 517. 1907.

Plant mass caespitose, entangled, floating, yellowish green; filaments 12-18 mic. in diameter, 2 cm. and more in length, rigid, very sparingly branched; sheaths colorless, thick, lamellose; trichomes 6-10 mic. in diameter, cylindrical, equal, constricted at joints; cells twice as long as wide, sometimes up to 15 mic. in diameter and shorter than the diameter; heterocysts quadrate or oblong, colorless; hormogones very long; cell contents blue-green.

Mexico. In swamps. Near Vera Cruz. (Miller).

411. **Scytonema mirabile** (Dillwyn) Bornet. Les Nostocacées hétérocystées du Systema Algarum de C. Agardh (1824) et leur Synonymie ac-

tuelle (1889). Bull. Soc. Bot. de France. 12. 1889. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 101. 1887. (*S. figuratum* Ag.) De Toni. Syll. Algar. 5: 517. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 60, 61. pl. 6. f. 1, 2. 1872. (*S. thermale* Kg., *S. calotrichoides* Kg.). **Nordstedt.** Die Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 6. 1878. **Wolle.** Fresh-Water Algae U. S. 251. pl. 183. f. 5-7. 1887; 259. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **West and West.** On some Fresh-water Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 271. 1895. **Setchell.** Notes on Cyanophyceae.—I. Erythea. 4: 89. 1896; Notes on Cyanophyceae.—II. Erythea. 4: 193. 1896. **Tilden.** American Algae. Cent. III. no. 290. 1898. (*S. myochrous* (Dillw.) Ag.). **West and West.** A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 287. 1898-1900. **Setchell.** Notes on Cyanophyceae.—III. Erythea. 7: 48. 1899. **Tilden.** American Algae. Cent. IV. no. 396. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 18. no. 857. 1901. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Tilden.** Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 166. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 195. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 625. 1905. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 631. 1909.

Plate XIII. fig. 2-5.

Plant mass woolly, widely expanded, spongy-tomentose, brownish black or blackish green; filaments 15-21 mic. in diameter, tortuous, entangled, 2-4 mm. or 1 cm. in thickness; sheaths lamellose, yellowish brown; layers of the sheath scarcely diverging; trichomes 6-12 mic. in diameter; basal cells long, cylindrical, the upper ones disc-shaped; heterocysts somewhat quadrate or longer than the diameter, brownish; cell contents yellowish green.

Alaska. On moist ground near Glacier Bay; in a freshwater stream emptying into Glacier Bay; on the perpendicular surface of a rock moistened by dripping water, Kukak Bay, July 1899. (Saunders). **Connecticut.** Coating moist limestone rocks. On shore of Housatonic River, near Gaylordsville. June, October 1901. (Holden). **New York.** Forming a dark brown coating on wet rocks. Niagara. (Wolle). **New Jersey.** Frequent on submerged sticks in ponds. (Wolle). **South Carolina.** Damp surface of hard clay; in wet boggy places on rotten pine boards, September 1869. (Ravenel). Sandy soil near Aiken. (Wolle). **Minnesota.** On sides of rocks in stone quarry. Minneapolis. May 1899. (Crosby). **Iowa.** On cliffs. Fayette. 1897. (Fink). **Colorado.** In pannose layers upon the "Pillars of Hercules," South Cheyenne Cañon, near Manitou. (Setchell). **Mexico.** (Müller). **West Indies.** On damp wall of dam. Sharp's River, St. Vincent. May 1892; on trees, summit of Trois Pitons (4,500 feet), November and December 1892; on rocks, Hamstead Valley (850 feet), Do-

minica, January and February 1896. (Elliott). **Hawaii.** In stagnant water. Mauna Kea, Hawaii. (Berggren, Schauinsland).

Var. *lepieurii* (Montagne) Bornet and Flahault. l. c. 103. De Toni. l. c. 520.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 32. 1865. **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 34. 1870-1877. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 21. no. 1014. 1903.

Outer layers of sheath gelatinous, colorless.

Canada. Warm sulphur springs, Banff, Alberta. June 1901. (Butler and Polley). **West Indies.** (Mazé and Schramm).

412. **Scytonema myochrous** (Dillwyn) Agardh. Dispositio Algar. sueciae. 38. 1812. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 104. 1887. De Toni. Syll. Algar. 5: 521. 1907.

Dickie. In Hooker. An Account of the Plants collected by Dr. Walker in Greenland and Arctic America during the Expedition of Sir Francis M'Clintock, R. N., in the Yacht "Fox." Journ. Linn. Soc. Bot. 5: 86. 1861; Notes on a Collection of Algae procured in Cumberland Sound by Mr. James Taylor, and Remarks on Arctic Species in General. l. c. 9: 242. 1867. **Wood.** Prodromus of a Study of the Fresh-Water Algae of Eastern North America. Proc. Am. Phil. Soc. 11: 129. 1869. (S. cataractae Wood); Contr. Fresh-Water Algae North America. 62. pl. 7. f. 1. 1872. **Rabenhorst.** Die Algen Europas. no. 2492. 1877. **Wolle.** Fresh-Water Algae. 6: 184. 1877. (S. brandegei Wolle); Fresh-Water Algae U. S. 252, 253. pl. 182. f. 1-3; pl. 183. f. 1-4; pl. 185. f. 1-7. 1887. (S. gracile Kg., S. turfosum Kg.). **Bennett.** Plants of Rhode Island. 114. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 3. no. 109. 1895. **Setchell.** Notes on Cyanophyceae.—II. Erythraea. 4: 192, 193. 1896. **Collins.** Some Perforating and other Algae on Fresh-Water Shells. Erythraea. 5: 96. 1897. **Saunders.** Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 195. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Buchanan.** Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 10. 1908.

Plate XIII. fig. 6.

Plant mass woolly, widely expanded, spongy-tomentose, brownish black or blackish green; filaments 18-36 mic. in diameter, 2-15 mm. long, tortuous, entangled; sheaths lamellose, yellowish brown; layers of the sheath diverging; trichomes 6-12 mic. in diameter; basal cells long, cylindrical, the upper ones disc-shaped; heterocysts somewhat quadrate or longer than their diameter, brown; gonidia spherical, yellowish brown; cell contents yellowish green.

Alaska. Forming small tufts on rocks in a brook emptying into Glacier Bay. (Saunders). **Greenland.** (Börjesen). **Canada.** Fresh water. Port Kennedy. (Walker). Cumberland Sound. (Taylor). Forming broad turf-

like coating on the rocks below the great cataract. Niagara Falls. (Wood). Dark brown coating on wet rocks. Niagara. (Wolle). **Rhode Island.** New Providence. (Bennett). **Connecticut.** Forming dark brownish patches on submerged limestone rocks. Twin Lakes, Salisbury. August, October 1892. (Holden). Growing on outside of Union shells. Twin Lakes, Salisbury, Litchfield County. August 1895. (Setchell and Holden). **New Jersey.** On rocky shores of Morris Pond. (Wolle). On moist ground. Closter, Bergen. (Austin). **Pennsylvania.** Moist ground in extended patches and on dripping rocks. (Wolle). **North Carolina.** Moist ground. (Ravenel). **Iowa.** Fayette. 1905. (Fink). **Colorado.** Wet rocks. (Brandegee). **Bermudas.** (Farlow).

413. *Scytonema badium* Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 184. 1877. De Toni. Syll. Algar. 5: 524. 1907.

Plant mass thin, brown (*badius*); filaments 40-75 mic. in diameter, somewhat erect, appressed, short; false branches flaccid, divaricate, single or in pairs; sheaths wide, yellowish olive; trichomes, 2-2.5 mic. in diameter, sometimes continuous, sometimes showing distinct transverse walls; cells about as long as wide; heterocysts scattered or situated at the base, somewhat spherical or oblong; cell contents pale blue-green.

New York. On old wood. Herkimer County. (Austin).

414. *Scytonema fuliginosum* Tilden. American Algae. Cent. VII. Fasc. 1. no. 629. 1909.

Plate XIII. fig. 7, 8.

Plant mass thin, bluish green; filaments 28-50 mic. in diameter; sheaths folded into many layers or laminations; layers much dilated, dark brown in thicker parts; trichomes 10-20 mic. in diameter; cells 1.4-5 mic. in length; heterocysts 12-16 mic. in diameter, spherical, oval or somewhat quadrate; cell contents gray green.

Hawaii. Forming a thin layer on bottom of small shallow tide pool just below high tide. Pahala Plantation beach, south shore of Hawaii. July 1900. (Tilden).

415. *Scytonema alatum* (Carmichael) Borzi. Morfologia e Biologia delle Alghe Ficocromacee. Nuovo Giorn. Bot. Ital. 11: 373. 1879. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 110. 1887. De Toni. Syll. Algar. 5: 528. 1907.

Harvey. Nereis Boreali-Americana. Part III. 99. pl. 48. A. f. 1-4. 1858. (*Petalonema alatum* Berk.). **Wood.** Contr. Hist. Fresh-Water Algae North America. 66. 1872. **Wolle.** Fresh-Water Algae U. S. 267. pl. 188. f. 15, 16. 1887. **Setchell.** Notes on Cyanophyceae.—II. Erythea. 4: 193. 1896. **Hone.** *Petalonema alatum* in Minnesota. Minn. Bot. Studies. 3: 47. pl. 13. 1903.

Plate XIII. fig. 9.

Plant mass caespitose, mucous, black or brown; 24-66 mic. in diameter, 4-8 mm. in length, flexuous, erect or appressed; false branches short, spreading, irregular in outline; sheaths forming lamellose wings or mem-

branaceous expansions, the outer layers white, somewhat transparent, the internal layers bright yellow, contracted at the heterocysts, very smooth on the surface; trichomes 9-15 mic. in diameter; cells shorter than the diameter; heterocysts spherical, brownish; cell contents blue-green or green.

New York. On dripping rocks under Biddle Stairs, Niagara Falls. 1849. (Harvey). "The only locality hitherto discovered for this plant is on the high cliff, near the Cave of the Winds, Niagara Falls. 'Twas found there twenty-five years since and it may be gathered there to-day." (Wolle). **Minnesota.** On gravel bed of a quiet stream, the outlet of an old tank near the Government Dam works. Near Minneapolis. October 1901. Hone.

416. *Scytonema junipericolum* Farlow in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 16. no. 756. 1900. De Toni. Syll. Algar. 5: 525. 1907.

Plant mass forming indefinite, pulvinate, tomentose, black expansions .2-3 mm. high; basal filaments 14-16 mic. in diameter, nearly prostrate; upper filaments 12-14 mic. in diameter; false branches in pairs, numerous, erect, soon dividing into Tolypothrix-like, tortuous, corymbose branchlets; sheaths about 2 mic. in thickness, lamellose, with diverging layers, with obtuse apex; cells at the base disc-shaped, the upper ones becoming cuboidal and often torulose; heterocysts 11-12 mic. in diameter, 6-7 mic. in length.

Bermudas. Common, forming dark velvety patches on the bark of *Juniperus bermudiana*. "Fairyland." January 1900. (Farlow).

417. *Scytonema crustaceum* Agardh. Syst. Algar. 39. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 106. 1887. De Toni. Syll. Algar. 5: 525. 1907.

Wolle. Fresh-Water Algae U. S. 263. 1887. (*Symphyosiphon crustaceus* Kg.) **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 28. no. 1358. 1907.

Plate XIII. fig. 10-12.

Plant mass cushion-shaped, black, .5-2 mm. in thickness; filaments 15-30 mic. in diameter, thick, short, erect, aggregated, often slightly thickened and decumbent, with numerous branches; false branches ascending, short, in pairs, coalesced at the base, finally becoming free; sheaths gelatinous, yellowish brown, lamellose, the layers diverging; trichomes 6-8 mic. in diameter; cells somewhat quadrate or depressed; heterocysts oblong, blue-green.

Connecticut. On limestone rock. Salisbury. November 1906. (Phelps). **Pennsylvania.** Not infrequent, on wet cliffs. (Wolle).

Var. *incrustans* (Kuetzing) Bornet and Flahault. l. c. 107. De Toni. l. c. 526.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 139. 1877; (*Symphyosiphon incrustans* Kg.). A Nostoc the Matrix of *Scytonema*. Bull. Torr. Bot. Club. 217. 1878. **Setchell.** Notes on Cyanophyceae.—II. Erythea. 4: 191. 1896.

False branches in pairs, included within a common sheath as far as the apex; gonidia spherical or oval; wall of gonidium deep brown.

New York. Common on rocks exposed to spray. Niagara Falls. (Wolle).

418. *Scytonema densum* (A. Braun) Bornet in Bornet and Thuret. Notes Algologiques. 152. 1880. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 109. 1887. De Toni. Syll. Algar. 5: 527. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 271. 1895. **Setchell.** Notes on Cyanophyceae.—II. Erythea. 4: 191. 1896; Notes on Cyanophyceae.—III. Erythea. 7: 48. 1899. **Collins.** The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901.

Plate XIII. fig. 13.

Plant mass dense, cushion-shaped, brown or black; filaments 24-40 mic. in diameter, 1 mm. in length, entangled; false branches erect, appressed; sheaths yellowish brown, gelatinous, lamellose, the younger ones pale yellow; trichomes 6-12 mic. in diameter; heterocysts somewhat quadrate; cell contents green.

New York. On rocks. Niagara. August 1876. (Wolle). **California.** Twin Oaks, San Diego County. (Koch). **West Indies.** Amongst *S. javanicum* on lime-trees. Shanford Estate, Dominica. November and December 1892. (Elliott). In turfs in moist places. Port Antonio, Jamaica. April 1893. (Humphrey).

419. *Symphyosiphon bornetianum* Wolle. Fresh-Water Algae U. S. 261. pl. 189. f. 4. 1887. De Toni. Syll. Algar. 5: 536. 1907.

Plate XIII. fig. 14.

Plant mass thin, with smooth surface, brownish or reddish brown; filaments 12-15 mic. in diameter, short, thick, with the branches forming a close, upright growth; sheaths close; cells somewhat longer or shorter than the diameter; heterocysts scattered, yellowish; cell contents brown or slightly blue-green.

South Carolina. On old bricks. Port Royal; on clay cliffs. (Wolle).

420. *Scytonema dubium* Wood. Contr. Hist. Fresh-Water Algae North America. 63. pl. 6. f. 3. 1872. De Toni. Syll. Algar. 5: 533. 1907.

Plant mass immersed; filaments 6-10 mic. in diameter, very long, closely interwoven, variously curved, usually sparingly branched; false branches usually single, more or less distant, moderately short, sometimes very short, abortive and somewhat crowded; sheaths close, usually rather thick and firm, transparent, colorless; trichomes often contained in distinct, cell-like apartments, sometimes continuous, with indistinct transverse walls; heterocysts cylindrical, two to six times longer than broad; cell contents finely granular, usually pale bluish green, sometimes bright blue-green.

New Jersey. On leaves of *Ranunculus aquatilis*. In Shepherd's

Mill Pond, near Greenwich, Cumberland County. 1869. (Wood).

421. *Scytonema hirtulum* (Kuetzing) Rabenhorst. Fl. Eur. Algar. 2: 265. 1865. De Toni. Syll. Algar. 5: 531. 1907.

Wolle. Fresh-Water Algae U. S. 261. pl. 189. f. 7. 1887. (*Symphysiphon hirtulus* Kg.).

Plate XIII. fig. 15.

Plant mass expanded, cushion-shaped, olivaceous-black, consisting of spine-shaped, wick-like bundles of filaments; filaments and false branches 10-15 mic. in diameter, ascending, slightly curved, parallel and more or less densely agglutinated below, usually free at the apices, obtusely rounded; sheaths colorless or yellowish, transparent, the external layers a little swollen with age, roughened, 20 mic. in thickness; trichomes 8-10 mic. in diameter; transverse walls distinct; cells equal to the diameter or a little shorter; heterocysts both basal and intercalary, single or in pairs, oblong, brown in color.

United States. On moist rocks and damp earth. (Wolle).

422. *Scytonema immersum* Wood. Contr. Hist. Fresh-Water Algae North America. 59. pl. 2. f. 9. 1872. De Toni. Syll. Algar. 5: 530. 1907.

Intermingled with other algae and adhering to aquatic plants; filaments about 10 mic. in diameter, elongate; false branches mostly in pairs, more or less distant, short or elongate; sheaths wide, transparent, colorless; apex of trichome obtusely rounded; transverse walls sometimes distinct, sometimes invisible; cells quadrate or shorter than the diameter; heterocysts distinct, single, intercalary, somewhat cylindrical, sometimes half as long as broad, sometimes nearly twice as long; cell contents bright blue-green.

New Jersey. Forming a flocculent, greenish black, slimy coating to the stems and finely dissected leaves of *Ranunculus aquatilis*. In Shepherd's Mill Pond, near Greenwich, Cumberland County. 1869. (Wood).

423. *Scytonema polymorphum* Naegeli. Rabenhorst. Fl. Eur. Algar. 2: 257. 1865. De Toni. Syll. Algar. 5: 532. 1907.

Moebius. Ueber einige in Portorico gesammelte Süsswasser- und Luft-Algen. Hedwigia. 27: 245. 1888.

Plant mass cushion-shaped, dark blue-green or blackish; filaments 7-27 mic. in diameter, variously curved, loosely entangled, sparingly branched; false branches single or in pairs; sheaths colorless or yellowish brown, transparent, lamellose; trichomes 5.8-14.5 mic. in diameter; transverse walls visible or invisible; cells shorter or up to three times longer than their diameter; heterocysts oblong, colorless or pale brown; cell contents light blue-green or lead-colored.

West Indies. Porto Rico. (Moebius).

424. *Scytonema rubrum* Montagne. Première Centurie de Plantes Cellulaires Exotiques. Ann. Sci. Nat. Bot. II. 8: 349. 1837; Histoire de l'Île de Cuba. 9. 1838. De Toni. Syll. Algar. 5: 532. 1907.

Filaments decumbent, reddish, dichotomously branched, entangled; false branches spreading, abruptly bent; cells shorter than their diameter.

West Indies. On fallen leaves. Cuba. (Montagne).

425. *Scytonema simplex* Wood. Contr. Hist. Fresh-Water Algae North America. 57. 1872. Wolle. Fresh-Water Algae U. S. 259. 1887. (S. *simplicis* Wood !!). De Toni. Syll. Algar. 5: 536. 1907.

Plant mass moderately thick, somewhat cushion-like, blackish green; filaments 10-15 mic. in diameter, very long, flexuously curved, sparingly branched or without branches; false branches in pairs or single, usually elongate; sheaths thick, transparent, often colorless, sometimes pale yellowish brown, mostly open and truncate at apex; trichomes 3-6 mic. in diameter; cells equal to seven times as long as broad (?), often separated, apical cells very short; heterocysts cylindrical, scattered, two to five times longer than their diameter; cell contents sparsely granular, pale greenish.

South Carolina. Adhering to the wet sides of a wooden gutter leading water from a spring. Aiken. September 1869. (Ravenel).

Genus **TOLYPOTHRIX** Kuetzing. Phyc. Gen. 227. 1843.

Filaments branched; false branches usually arising in the immediate region of the heterocysts, rarely between two heterocysts, single; sheaths somewhat thin, flexible, more or less fragile; gonidia spherical, oval or elliptical, often many in a series; wall of gonidium smooth, thin.

I Sheaths thin.

1 Plants living in water

- | | |
|---------------------------------------|-----------------------|
| (1) Filaments 8-10 mic. in diameter | <i>T. tenuis</i> |
| (2) Filaments 9-12.5 mic. in diameter | <i>T. lanata</i> |
| (3) Filaments 10-15 mic. in diameter | <i>T. distorta</i> |
| (4) Filaments 12-17 mic. in diameter | <i>T. penicillata</i> |

2 Plants living in moist places

- | | |
|--------------------------------------|---------------------|
| (1) Filaments 10-15 mic. in diameter | <i>T. byssoidea</i> |
| (2) Filaments 15-25 mic. in diameter | <i>T. ravenelii</i> |

II Sheaths thick.

1 Plants living in water

- | | |
|--------------------------------------|----------------------|
| (1) Filaments 5-6 mic. in diameter | <i>T. setchellii</i> |
| (2) Filaments 12-15 mic. in diameter | <i>T. limbata</i> |

2 Plants living in moist places; filaments 12-15 mic. in diameter

T. rupestris

Species not well understood

T. glacialis

426. *Tolypothrix tenuis* Kuetzing. Phyc. Gen. 228. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 122. 1887. De Toni. Syll. Algar. 5: 545. 1907.

Wolle. Fresh-Water Algae. VII. Bull. Torr. Bot. Club. 10: 20. 1883.
Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **West and West.** On some Fresh-water Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 271. 1895.
Setchell. Notes on Cyanophyceae.—II. Erythea. 4: 193. 1896. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 6. no. 257. 1897. **Tilden.** American Algae. Century IV. no. 397. 1900. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 196. 1903. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 628. 1909.

Plant mass caespitose-floccose, rarely extended in a cushion-like layer, blue-green, becoming brownish with age; filaments 8-10 mic. in diameter, 2 cm. in height, repeatedly branched; false branches erect, spreading, flexuously curved; sheaths membranaceous, thin, usually inflated at the base of the branches, colorless or yellowish; trichomes 6-8 mic. in diameter, cylindrical; cells equal to or longer than the diameter; heterocysts one to five, often colorless; cell contents blue-green.

Alaska. Forming brownish or blue-green tufts, attached to rocks in fresh water. Glacier Bay; Popof Islands. (Saunders). **Massachusetts.** On mosses and various small plants. Spot Pond, Middlesex Fells. (Collins). **New Jersey.** Often very abundant, in ponds. (Wolle). Plainfield. (Balen). **Maryland.** On grasses in pools in abandoned brickyard. Baltimore. October 1896. (Humphrey). **Michigan.** Ann Arbor. (Reighard). **Minnesota.** In tank. Botanical Department, University of Minnesota, Minneapolis. March 1909. (Tilden). **South Dakota.** Forming blue-green tufts or coatings on reeds, finally becoming loosened and floating. Big Stone Lake. August 1898. (Saunders). **Washington.** Near Newhall, Orcas Island; Green Lake, Seattle. (Gardner). **West Indies.** On damp wall of dam. Sharp's River, St. Vincent. May 1892. (Elliott).

Forma *bryophila* Rabenhorst. Fl. Eur. Algar. 2: 273. 1865. De Toni. 1. c. 547.

Wolle. Fresh-Water Algae U. S. 265. pl. 181. f. 5-7. 1887.

Forming a widely extended, thin, papery layer; trichomes 2.5-3 mic. in diameter.

New Jersey. Often very abundant in ponds. (Wolle). **Pennsylvania.** (Wolle).

427. *Tolypothrix lanata* (Desvaux) Wartmann in Rabenhorst. Die Algen Sachsens. no. 768. 1858. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 120. 1887. De Toni. Syll. Algar. 5: 542. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 66. pl. 8. f. 1. 1872. (*T. distorta* var. Wood). **Wolle.** Fresh Water Algae. IV. Bull. Torr. Bot. Club. 7: 44. 1880. (*T. aegagropila* Kg.); Fresh-Water Algae U. S. 263-265. pl. 180. f. 5-7, 14-16; pl. 181. f. 1-4. 1887. (*T. muscicola* Kg.,

T. pulchra Kg., *T. flaccida* Kg.). Collins. Algae of Middlesex County. 13. 1888. Harvey. The Fresh-Water Algae of Maine.—I. Bull. Torr. Bot. Club. 15: 161. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. Johnson. Fresh Water Algae. Northwestern University. Report Dept. Nat. Hist. 22. 1891. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 209. 1896; Fasc. 20. no. 956. 1904. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 195. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905.

Plate XIV. fig. 1.

Plant mass caespitose-floccose, rarely extended in a cushion-like layer, blue-green, becoming brownish with age; filaments 9-12.5 mic. in diameter, 2 cm. in height, repeatedly branched; false branches erect, spreading, flexuously curved, sheaths membranaceous, thin, usually inflated at the base of the branches, colorless or yellowish; trichomes about 10 mic. in diameter, cylindrical; cells equal to or longer than the diameter; heterocysts one to four, often colorless; cell contents blue-green.

Alaska. Forming blackish brown felt-like mats in shallow, running water. Unalaska. June 1899; forming dark brown, felt-like layers on rocks or on the bottom of shallow, fresh water or dried streams, Iliuliuk. (Setchell and Lawson). **Maine.** Old well, College Farm, near Orono. 1887. (Harvey). **Massachusetts.** Spot Pond, Stoneham; floating in clay pits, Medford, April 1893. (Collins). **Connecticut.** Lime Rock. (Adam). Mostly on aquatic mosses in summer and autumn, in quiet water. Pequonnock River, Bridgeport. November 1890; Lake Saltonstall, near New Haven, September to December. (Holden). **New Jersey.** Clusters torn from attachment by storm. Budd's Lake. August 1881. (Wolle). **Pennsylvania.** Forming little bright green balls, adherent to aquatic plants in an aquarium. Philadelphia. (Wood). In ponds. (Wolle). **Indiana.** In shallow ponds. Edgemoor, Lake County. August 1890. (Johnson). **Montana.** On dripping rocks and on wet wood-work of dams, flumes, etc., in springs and streams. July to October. (Anderson and Kelsey). **Washington.** Near Seattle. (Kincaid). **West Indies.** (Mazé).

Var. *hawaiiensis* Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 6. 1878. (*T. muscicola*). De Toni. l. c. 545.

Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 625. 1905.

Filaments 9-14 mic. in diameter; trichomes 6-8 mic. in diameter; cells 4-7 mic. in length; heterocysts 9 mic. in diameter, 10-15 mic. in length.

Hawaii. Adhering to leaves in stagnant water. Mauna Kea, Hawaii. (Berggren).

428. **Tolypothrix distorta** (Hofman-Bang) Kuetzing. Phyc. Gen. 228. 1843. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 119. 1887. De Toni. Syll. Algar. 5: 541. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 65. 1872.

Wolle. Fresh-Water Algae U. S. 263. pl. 180. f. 1-3. 1887. Bennett. Plants of Rhode Island. 114. 1888. (*Scytonema gracile* Kg.). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 144. 1891. Tilden. American Algae. Cent. I. no. 82. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895; American Algae. Cent. V. no. 478. 1901; Collection of Algae from the Hawaiian Islands. Hawaiian Almanac and Annual for 1902. 111. 1901; Algae Collecting in the Hawaiian Islands. Postelsia: The Year Book of the Minnesota Seaside Station. 1: 153. 1902. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 195. 1903.

Plate XIV. fig. 2-4.

Plant mass caespitose-floccose or extended in a cushion-like layer, blue-green or brownish; filaments 10-15 mic. in diameter, 1-3 cm. in length, repeatedly branched; false branches erect, spreading, flexuously curved; sheaths membranaceous, thin, here and there inflated at the base of the branches, colorless, rarely yellowish; trichomes 9-12 mic. in diameter, sometimes constricted at joints; cells equal to or shorter than the diameter; heterocysts solitary, rarely in twos or threes; cell contents blue-green.

Alaska. Floating or attached to plants or stones in quiet, fresh water. Cape Nome. (Setchell). Vermont. Pond waters. East Charlotte. (Wolle). Rhode Island. (Thwaites). Warden's Pond. (Wood). North. Providence. (Bennett). New York. Reservoir Pond, West Point. (Wood). New Jersey. On rocky shores of Morris Pond, Morris. (Wolle). Wisconsin. Fourth Lake, Madison. (Bailey). Minnesota. Artificial lake. Minneapolis. August 1894. (Tilden). Montana. Everywhere in flowing water, growing caespitose on the rocks. July to October. (Anderson and Kelsey). Washington. Fidalgo Island; Lake Washington, Seattle. (Gardner). Hawaii. Forming tiny bluish green tufts or cushions on rocks in mountain stream. Kaliawaa Stream, Makao, Koolauloa, Oahu. June 1900. (Tilden).

429. *Tolypothrix penicillata* (Agardh) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 380. 1875. Bornet and Thuret. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 123. 1887. De Toni. Syll. Algar. 5: 549. 1907.

Farlow. Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. Wolle. Fresh-Water Algae U. S. 252. pl. 183. f. 11-13. 1887. (*Scytonema naegelii* Kg.). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889.

Plate XIV. fig. 5.

Plant mass penicillate-caespitose, deep brown in color; filaments 12-17 mic. in diameter, 2 cm. in length, repeatedly branched; false branches erect at the base, flexuously curved, elongate; sheaths firm, membranaceous, at first colorless, afterwards becoming brownish; trichomes about 10 mic. in diameter, cylindrical; cells 4-12 mic. in length; heterocysts usually solitary, yellowish; cell contents blue-green.

New Hampshire. On submerged mosses. Mill Brook, Shelburne. (Farlow). **New Jersey.** On moist rocks. Closter and Godwinville. (Austin).

430. *Tolypothrix byssoidea* (Hassall) Kirchner in Engler and Prantl. Nat. Pflanz. I. 1a. 80. 1900. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 116. 1887. (*Hassallia byssoidea* Hass.) De Toni. Syll. Algar. 5: 551. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 68. pl. 9. f. 1. 1872. (*Sirosiphon scytonematoides* Wood). **Wolle.** Fresh-Water Algae U. S. 266. pl. 181. f. 8-11. 1887. (*T. truncicola* (Rab.) Wolle). **Collins.** Algae of Middlesex County. 13. 1888. **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 428. 1895. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 6. no. 258. 1897. **West and West.** A Further Contribution to the Freshwater Algae of the West Indies. Journ. Linn. Soc. Bot. 34: 287. 1898-1900.

Plate XIV. fig. 6.

Plant mass woolly, cushion-like, brownish or black; filaments 10-15 mic. in diameter, 1 mm. in length, irregularly branched; false branches short, erect, spreading; sheaths close, thin, orange or brown, fragile, tubular, continuous; trichomes 9-11 mic. in diameter, constricted at joints; cells two or three times shorter than the diameter; heterocysts, basal, one or two; cell contents olive.

Massachusetts. Newton. (Farlow). Among other algae. Cascade, Middlesex Fells. (Collins). **Connecticut.** Growing on rocks at the water's edge. Quinebaug River, Lisbon. (Setchell). **South Carolina.** Growing on the limbs of *Myrica cerifera*. February. (Ravenel). **West Indies.** On leaves. Wotten Waven, Dominica. (Elliott).

Forma *saxicola* Grunow. Bornet and Flahault. l. c. 117. De Toni. l. c. 552.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 195. 1903.

Filaments 14-18 mic. in diameter; sheaths often striated and corrugated; trichomes 12 mic. in diameter.

Alaska. Among mosses on dripping rocks. Amaknak Island, Bay of Unalaska. (Setchell and Lawson).

Forma *cylindrica* Tilden. American Algae. Cent. IV. no. 398. 1900. (*Hassallia byssoidea cylindrica*).

Trichomes 5-6 mic. in diameter, cylindrical; heterocysts basal or intercalary.

Canada. On vertical rocks just above high tide. Baird Point, Strait of Juan de Fuca, Minnesota Seaside Station, Vancouver Island, British Columbia. August 1898. (Tilden).

431. *Tolypothrix ravenelii* Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 285. 1879; Fresh-Water Algae U. S. 265. pl. 180. f. 8-10. 1887. De Toni. Syll. Algar. 5: 542. 1907.

Plate XIV. fig. 7.

Plant mass thin, more or less expanded, reddish brown; filaments 15-25 mic. in diameter, elongate, false branches elongate; sheaths thin, close, yellowish or dark-colored; trichomes often interrupted; cells equal to or twice as short as their diameter; transverse walls distinct; heterocysts basal or intercalary, usually single, oblong, yellowish; cell contents finely granular, yellowish or reddish.

Florida. On sandstone rock. Gainesville. December 1877. (Ravenel).

432. *Tolypothrix setchellii* Collins. Some Perforating and other Algae on Freshwater Shells. Erythea. 5: 96. pl. 4. 1897. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 310. 1897. De Toni. Syll. Algar. 5: 548. 1897.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 196. 1903.

Plate XIV. fig. 8.

Filaments 5-6 mic. in diameter, up to 7 dm. in length, scattered or arranged in parallel series and forming a layer, flexuous, occasionally thickened, repeatedly branched; false branches spreading; sheaths thick, gelatinous, refractive, colorless or yellowish; trichomes 4 mic. in diameter, constricted at joints; cells equal to or longer than the diameter; heterocysts disc-shaped; cell contents blue-green.

Alaska. "A dwarf species." On Ch a r a. Near Iliuliuk, Unalaska. (Lawson). Connecticut. On shells. Twin Lakes, Salisbury, Litchfield County. August 1897. (Setchell and Holden).

433. *Tolypothrix limbata* Thuret in Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 124. 1887. De Toni. Syll. Algar. 5: 550. 1907.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 196. 1903.

Plant mass floccose-caespitose, blue-green; filaments 12-15 mic. in diameter, 2-3 mm. in length, repeatedly branched; false branches erect, spreading, flexuously curved; sheaths refringent, colorless, lamellose, with the outer layers mucous; trichomes 6-9 mic. in diameter, constricted at joints; cells equal to or a little longer than the diameter; heterocysts one to two; cell contents dull blue-green.

Washington. Growing on the side of a jar in the botanical laboratory. University of Washington, Seattle. (Gardner).

434. *Tolypothrix rupestris* Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 185. 1877; in Rabenhorst. Die Algen Europas. no. 2573. 1879; Fresh-Water Algae U. S. 265. pl. 180. f. 11-13. 1887.

Plate XIV. fig. 9.

Plant mass expanded, variously tinged with red, purple and black; filaments 9-12-15 mic. in diameter, loosely interwoven, much branched; sheaths wide, yellowish, or colorless; cells as long or twice as long as their diameter; heterocysts spherical or oblong, two or three in series; cell contents granular, dull blue-green.

Pennsylvania. On dripping, gelatinous, exposed rocks. Delaware Water Gap. July. (Wolle).

435. *Tolypothrix glacialis* Dickie. On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. De Toni. Syll. Algar. 5: 556. 1907.

Plant mass caespitose, brown; filaments 15 mic. in diameter, rigid; sheaths somewhat lamellose; transverse walls indistinct.

Arctic Regions. Forming a brownish crust on decayed *Nostoc*. Edge of Glacier Lake, Cape Baird. (300 feet), 81° 30' N. (Dickie).

Genus **DESMONEMA** Berkeley and Thwaites.

English Botany. 1849.

Plant mass caespitose, penicillate; filaments somewhat dichotomously divided, straight; sheaths thin; trichomes two or more within the sheath; heterocysts basal; gonidia large, oval or elliptical, single or in short series; wall of gonidium somewhat thick.

436. *Desmonema wrangelii* (Agardh) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 127. 1887. De Toni. Syll. Algar. 5: 558. 1907.

Wolle. Fresh-Water Algae U. S. 237. pl. 168. f. 3, 4. 1887. (*Calothrix dillwynii* Hass.) **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. (Also *C. radiosa* (Kg.) Kirchn.). **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 428. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 3. no. 108. 1895. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 398. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 196. 1903.

Plate XIV. fig. 10.

Plant mass 5-6 mm. in height, caespitose, formed of penicillate fascicles, gelatinous, dark green; filaments erect, somewhat flexuous, repeatedly subdichotomously branched; sheaths thin, continuous, colorless or yellowish; trichomes 9-10 mic. in diameter, constricted at the joints; cells three times shorter than the diameter; heterocysts one, two or none; cell contents blue-green.

Alaska. In a clear brook, emptying into Glacier Bay; in brook, Popof Island. (Saunders). On stones in brooks or lakes, or even in pools on the tundra. St. Michael. (Setchell). Near Iliuliuk, Unalaska. (Setchell and Lawson). **Connecticut.** Very abundant. Forming small tufts or extended

patches of a blackish green color on stones in the swiftest currents of Roaring Brook, Cheshire. May 1894. (Setchell). **New Jersey.** Swamps; Morris Pond, Morris. (Wolle). **Maryland.** Garrett County. (Wolle).

Genus **DIPLOCOLON** Naegeli in Itzigsohn.
Phykologische Studien. Part I. 160. 1857.

Plant mass gelatinous, terrestrial; colonies irregular in shape, constricted, somewhat club-shaped; filaments several, contorted within a common tegument, branched; false branches solitary or in pairs, usually arising between two heterocysts, but rarely in the immediate region of the heterocysts; trichomes single within the sheath.

437. **Diplocolon heppii** Naegeli in Itzigsohn. Phykologische Studien. Nova Acta Acad. Leopold-Carolin. der Nat. 26: Part I. 160. pl. 11. (excl. f. 8-12). 1857. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 129. 1887. De Toni. Syll. Syll. Algar. 5: 561. 1907.

Wolle. Fresh-Water Algae. II. Bull. Torr. Bot. Club. 6: 139. 1877; Fresh-Water Algae. U. S. 260. pl. 195. f. 1-9. 1887. (*Scytonema heppii* (Naeg.) Wolle). **Setchell.** Notes on Cyanophyceae.—II. Erythea. 4: 193. 1896.

Plate XIV. fig. 11.

Plant mass caespitose, grumous-gelatinous, brownish becoming black; colonies club-shaped, gelatinous, irregularly dilated, up to 1 mm. in thickness, yellowish brown; common tegument lamellose, yellowish brown; filaments 20-28 mic. in diameter, repeatedly branched within the common tegument, flexuously curved and densely interwoven; trichomes constricted at joints; cells and heterocysts 6-10 mic. in diameter, somewhat spherical; cell contents blue-green.

New York. Forming a blackish brown gelatinous stratum upon rocks. Niagara Falls. (Wolle). **Florida.** On old wood. March 1878. (Wolle).

Family IV. STIGONEMACEAE

Filaments free, rarely laterally aggregated, scattered, frequently branched; sheaths thick, firm, often irregular; trichomes consisting of one or several rows of cells, with heterocysts; heterocysts often lateral, sometimes intercalary; reproduction by means of vegetative division, hormogones and gonidia.

I Sheaths distinct, definite.

1 Filaments free

(1) Trichomes consisting of one row of cells

A Branches of two kinds, the one cylindrical, the other flagelliform; heterocysts terminal or lateral **Mastigocoleus**

B Branches unilateral, usually tapering at the apex; heterocysts intercalary **Hapalosiphon**

(2) Trichomes consisting of one to several rows of cells

A Branches unilateral, thin, finally forming hormogones

Fischerella

B Branches scattered; hormogones formed in the apices of the branches or in special short branches

Stigonema

2 Filaments growing together forming a cushion-like mass

Capsosira

II. Sheaths confluent into a gelatinous amorphous mass

Nostochopsis

Genus **MASTIGOCOLEUS** Lagerheim. *Notarisia*. 1: 65. 1886.

Filaments free, irregularly branched; branches of two kinds, the one cylindrical, the other flagelliform, tapering off into a hair-like apex; sheaths continuous; trichomes, except in the branches, single within the sheath; heterocysts single, rarely in pairs, terminal or lateral, sometimes intercalary; gonidia unknown; reproduction by means of hormogones; cell contents homogeneous.

438. *Mastigocoleus testarum* Lagerheim. Note sur le *Mastigocoleus*, Nouveau Genre des Algues Marines de l'Ordre des *Phycochromacées*. *Notarisia*. 1: 65. pl. 1. 1886. Borner and Flahault. *Revis. des Nostoc*. *Ann. Sci. Nat. Bot.* VII. 5: 54. 1887. De Toni. *Syll. Algar.* 5: 564. 1907.

Collins. *Algae*. Rand and Redfield's *Flora of Mount Desert Island, Maine*. 247. 1894. Collins, Holden and Setchell. *Phyc. Bor.-Am. Fasc.* 5. no. 213. 1896. Setchell. Notes on *Cyanophyceae*.—III. *Erythea*. 7: 47. 1899. Collins. Preliminary Lists of New England Plants.—V. Marine *Algae*. *Rhodora*. 2: 42. 1900; *The Algae of Jamaica*. *Proc. Am. Acad. Arts Sci.* 37: 241. 1901; *Phycological Notes of the late Isaac Holden*.—II. *Rhodora*. 7: 223. 1905.

Plate XIV. fig. 12.

Filaments 6-10 mic. in diameter, variously curved; sheaths thin, colorless; trichomes 3.5-6 mic. in diameter; cells cylindrical or nearly so; heterocysts exceeding the diameter of the trichome, 6-18 mic. wide and long; cell contents greenish.

Canada. In oyster shells. Malpeque, Prince Edward Island. (Faull). **Maine.** Growing in the substance of dead shells. Seal Harbor. (Collins). **Massachusetts.** In shells of *Mya arenaria* on a sandy beach below low water mark. Quisset. July 1893, 1895. (Setchell). **Rhode Island.** (Collins). **Connecticut.** In shells. Fresh Pond. August, September. (Holden). **California.** In shells of the Eastern oyster. Near Bay Farm Island, Alameda County. (Setchell). **West Indies.** In old shells. Kingston, Jamaica. 1897. (Humphrey). Jamaica. (Flahault).

Genus **HAPALOSIPHON** Naegeli in Kuetzing.

Spec. Algar. 894. 1849.

Plant mass caespitose-floccose, thin, aquatic; filaments free, not grow-

ing together laterally, branched, consisting of a single row of cells, rarely of two rows, enclosed within a sheath; branches erect, usually about the same thickness as the creeping primary filament, commonly unilateral, long, flexuous, very slightly tapering; sheaths continuous, strong, of uniform thickness; sheaths of the branches thinner than those of primary filaments, usually colorless; heterocysts intercalary; wall of gonidium thick, yellowish brown.

I Plants living in fresh water.

- 1 Filaments decumbent, branched on all sides; branches 6-8 mic. in diameter; cells elliptical depressed *H. flexuosus*
- 2 Plant mass caespitose, orange brown; primary filaments 11.5-12.5 mic. in diameter; trichomes 7.5-8 mic. in diameter *H. aureus*
- 3 Plant mass floccose, caespitose, dull blue-green; primary filaments 21-24 mic. in diameter *H. fontinalis*

II Plants living in hot water

- 1 Plant mass cushion-like, irregular or expanded, blue-green; primary filaments 3-6 mic. in diameter *H. laminosus*
- 2 Plant mass widely expanded, bright blue-green; trichomes 3-11 mic. in diameter *H. major*

III Plants living on bark of trees

- 1 Plant mass caespitose, small, blue-green; filaments 4-7 mic. in diameter *H. intricatus*
- 2 Filaments 7-10 mic. in diameter; trichomes 7-9.5 mic. in diameter *H. arboreus*

439. *Hapalosiphon flexuosus* Borzi. Alghe d'Acqua Dolce della Papuasias. La Nuova Notarisia. 43. 1892. De Toni. Syll. Algar. 5: 570. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 272. 1895.

Filaments decumbent, branched on all sides, consisting of a single row of cells; branches 6-8 mic. in diameter, about equally thick in all parts, flexuously interwoven; sheaths thin, smooth; cells elliptical depressed; heterocysts similar to vegetative cells in form and size.

West Indies. In stream. Grande Soufrière, Dominica. November, December 1892. (Elliott).

440. *Hapalosiphon aureus* West and West. Welwitsch's African Freshwater Algae. Journ. of Bot. 241. 1897. De Toni. Syll. Algar. 5: 571. 1907.

West. West Indian Freshwater Algae. Journ. of Bot. 42: 291. 1904.

Plant mass caespitose, densely interwoven, orange brown, growing among other algae; primary filaments 11.5-12.5 mic. in diameter, tortuous and interwoven, formed of a single series of cells; sheaths firm, tenacious, thick, orange brown, transparent, finally becoming punctulate; trichomes 7.5-8 mic. in diameter; cells somewhat quadrate or spherical, shorter than the diameter and somewhat ellipsoid, or oblong and seven or eight times as long as broad; branches 6.5-9.5 mic. in diameter, frequently unilateral,

single or in pairs, long and flexuous, more slender than the primary filament, sometimes branched; sheaths thick and usually colorless; cells of the branches variable, 4-6.5 mic. in diameter, similar to those in the primary filament, often indistinct; heterocysts up to 6 mic. in diameter, 7-21 mic. in length, rectangular, oblong, intercalary; gonidia not known; cell contents finely granular, pale blue-green.

West Indies. Bay Estate, Barbados. (Howard).

441. *Hapalosiphon fontinalis* (Agardh) Bornet. Les Nostocacées Hétérocystées du Systema Algarum de C. A. Agardh (1824) et leur Synonymie actuelle (1889). Bull. Soc. Bot. de France. 36: 13. 1889. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 61. 1887. (*H. pumilus* Kirchn.). De Toni. Syll. Algar. 5: 568. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 7. 1878. (*H. braunii* Naeg.). **Wolle.** Fresh-Water Algae. V. Bull. Torr. Bot. Club. 8: 39. 1881. (*H. brebissonii* Kg.); Fresh-Water Algae U. S. 275, 277. pl. 196, f. 2-4, 22, 23. 1887. (*H. braunii* Kg., *H. fuscens* Kg.). **Harvey.** The Fresh-Water Algae of Maine.—I. Bull. Torr. Bot. Club. 15. 161. 1888. **Bennett.** Plants of Rhode Island. 114. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 606. 1889. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 30. 1894. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901. **Saunders.** The Algae. Harri-man Alaska Expedition. Proc. Wash. Acad. Sci. 3: 399. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 196. 1903. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 625. 1905. **Tilden.** American Algae. Cent. VII. Fasc. 1. no. 627. 1909.

Plate XIV. fig. 13.

Plant mass floccose, caespitose, dull blue-green, 3 mm. in height; primary filaments 21-24 mic. in diameter, creeping, interwoven, densely branched on the upper side, containing a single row of cells, rarely two or three, somewhat equal in diameter; sheaths somewhat thick, septate; secondary filaments 9-12 mic. in diameter, long, simple; sheaths continuous; trichomes consisting of a row of single, cylindrical cells; heterocysts intercalary; hormogones 6 mic. in diameter, 100-300 mic. in length, made up of from 14-50 cells.

Alaska. In a freshwater pond near Seldovia, Cook Inlet. (Saunders). **Maine.** Old well. College Farm, near Orono. (Harvey). **Massachusetts.** On the under side of *Nuphar* leaves. Spot Pond and Shiner Pool, Middlesex Fells. (Collins). **Rhode Island.** Spectacle Pond. (Bennett). **New Jersey.** On submerged plants in ponds. Dennisville, Atsion, Hammonton. (Wolle). **Minnesota.** Lake Kilpatrick. June 1893. (Tilden). On perpendicular rocks in stone quarry. Near campus, University of Minnesota, Minneapolis. September 1904. (Lippold). **West Indies.** On rock. "Wag

Water," Castleton, Jamaica. April 1893. (Humphrey). **Hawaii.** Adhering to leaves, in stagnant water. Mauna Kea, Hawaii. (Berggren).

Var. *tenuissimus* (Grunow) Collins and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 212. 1896. De Toni. Syll. Algar. 5: 570. 1907.

Wolle. Fresh Water Algae. V. Bull. Torr. Bot. Club. 8: 39. 1881. (*H. tenuissimus* Grun.); Fresh-Water Algae U. S. 277. pl. 196. f. 20, 21. 1887. **Bennett.** l. c. 114. **Wolle and Martindale.** l. c. 606.

Plant mass floccose; filaments irregularly branched in a squarrose manner; branches spreading; sheaths very close, colorless, transparent; trichomes 3-4.2 mic. in diameter, often interrupted, variously curved, with indistinct, transverse walls; nearly equal in length to the diameter.

Massachusetts. Spot Pond, Medford. September 1890. (Collins). **Rhode Island.** Blackmore Pond. (Bennett). **Connecticut.** Attached to under side of *Nuphar* leaves. Mill Pond, Lantern Hill, Ledyard. September 1892. (Setchell). **New Jersey.** (Wolle). **Pennsylvania.** (Wolle). **Florida.** (Wolle). **Minnesota.** (Wolle).

442. *Hapalosiphon laminosus* (Kuetzing) Hansgirg. Ueber den Polymorphismus der Algen. Bot. Centralblatt. 22: 48. 1885. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 55. 1887. De Toni. Syll. Algar. 5: 565. 1907.

Setchell. Notes on Cyanophyceae.—III. Erythea. 7: 47. 1899. **Collins.** **Holden and Setchell.** Phyc. Bor.-Am. Fasc. 18. no. 858. 1901. **Setchell.** The Upper Temperature Limits of Life. Science. 17: 395. 1903.

Plate XIV. fig. 14, 15.

Plant mass irregular or expanded, carneous-spongiose or compact, partly hardened with calcium carbonate, blue-green; filaments interwoven, showing great variety of form; mature filaments 6 mic. in diameter, with distinct sheath, often constricted at joints, containing a single row of cells, rarely two rows, the cells being spherical depressed, barrel-shaped or cylindrical, branched; branches unilateral, erect, more slender than the primary filament, composed of long, cylindrical cells; young filaments similar to those of *Anabaena*, either with or without sheaths, crowded, with a somewhat parallel arrangement, torulose in middle portion, tapering at the ends, sometimes simple, sometimes branched; branches single or in pairs, abruptly bent, with long, narrow cells; heterocysts intercalary, often wider than the vegetative cells, spherical or oblong.

California. In long, dark, emerald green, penicillate tufts, waving in a stream of hot water (temperature 49-50° C.). Arrowhead Hot Springs, near San Bernadino. April 1898. (Setchell).

"Within the strictly thermal limits (waters over 43°-45° C.), only one member of the higher and heterocysted Cyanophyceae has been noted, viz., *Hapalosiphon laminosus*."—Setchell.

Note.—*H. major* grows luxuriantly in water of a temperature of 54° C., and even higher.

443. *Hapalosiphon major* Tilden. American Algae. Century II. no. 167.

1896; Observations on some West American Thermal Algae. Bot. Gaz. 25: 97. pl. 9. f. 10-13. 1898. De Toni. Syll. Algar. 5: 565. 1907.

Plate XV. fig. 1-4.

Plant mass widely expanded, bright blue-green in color; filaments branched; branches single or in pairs, sometimes abruptly bent; trichomes 3-6 mic. in diameter, sometimes cylindrical with indistinct transverse walls, sometimes consisting of very long cells or short somewhat quadrate cells or even spherical cells, the latter up to 11 mic. in diameter; heterocysts 8 mic. in diameter, 8-16 mic. in length, intercalary, oblong, barrel-shaped.

Wyoming. Completely coating bed of very swift mountain rivulet, at vent of hot spring. Temperature of spring 61° C. The growth of the plant begins here and disappears at a distance of fifty-five feet from spring where the temperature is 51° C. The most luxuriant growth is thirty-five feet from the spring at a temperature of 54° C. On a mountain near Lower Geyser Basin, Yellowstone National Park. June 1896. (Tilden). **Oregon.** In hot spring. Temperature 55° C. Cascade Mountains, lat. 45° 20'. 1895. (Lloyd).

"The filaments of *H. major* are nearly twice the diameter of *H. laminosus* Hansg. An important character of the latter plant is its habit of forming crystals of lime, according to Cohn who studied the plant at Carlsbad. The Yellowstone species occurred in silicious waters only, at least it was not discovered at Mammoth Hot Springs, where the waters contain calcium carbonate."—Tilden.

444. *Hapalosiphon intricatus* West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 271. 1895; A Further Contribution to the Freshwater Algae of the West Indies. l. c. 34: 286. 1899. De Toni. Syll. Algar. 5: 571. 1907.

Plate XV. fig. 5.

Plant mass caespitose, small, blue-green; filaments 4-7 mic. in diameter, densely interwoven and variable, sparingly branched, containing a single row of cells; branches single, unilateral, flexuous, similar to the primary filament, with or without a sheath; mature sheaths close, usually distinct; cells variable, up to three times longer than their diameter, often equal and somewhat rotund, or elongate; heterocysts 3.8-5.5 mic. in diameter, one to three times longer than diameter, somewhat quadrate or oblong, scattered.

West Indies. In little intricate tufts among the leaves of *Leucobryum*, on trees, summit of Trois Pitons (4,500 feet), Dominica. November, December 1892; in stream, Wotten Waven, Dominica, January, February 1896. (Elliott).

445. *Hapalosiphon arboreus* West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 272. 1895. De Toni. Syll. Algar. 5: 572. 1907.

Plate XV. fig. 6, 7.

Primary filaments 7-10 mic. in diameter, flexuous, here and there branched on one side, formed from a single row of cells; sheaths close, thin, colorless; branches short, resembling the primary filaments, but more slender; cells 7-9.5 mic. in diameter, 7-19 mic. in length; heterocysts 6-9 mic. in diameter, 9-11 mic. in length, quadrate or oblong, intercalary.

West Indies. On trees. Summit of Trois Pitons (4,500 feet), Dominica. November, December 1892. (Elliott).

Genus **FISCHERELLA** (Bornet and Flahault) Gomont.

Journ. de Bot. 1. 1895.

Plant mass forming a continuous, more or less expanded layer, terrestrial; filaments of two kinds; primary filaments creeping, containing one or two rows of cells, unilaterally very much branched; branches or secondary filaments erect, elongate, more slender than the primary, containing very long hermogones within the sheath.

I Plants living in moist places; primary filaments 6-9 mic. in diameter
F. ambigua

II Plants living in moist places or in hot water; primary filaments 10-13 mic. in diameter
F. thermalis

446. **Fischerella ambigua** (Naegeli) Gomont. Note sur le *Scytonema ambiguum* Kuetz. Morot. Journ. de Bot. 9: 49. pl. 3. 1895. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 100. 1887. (*Scytonema ambiguum* Kg.). De Toni. Syll. Algar. 5: 576. 1907.

Wolle. Fresh-Water Algae U. S. 262. pl. 189. f. 2. 1887. (*Symphysiphon ambiguum* Naeg.). **Collins.** Algae of Middlesex County. 13. 1888. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 270. 1895; A Further Contribution to the Freshwater Algae of the West Indies. 1. c. 34: 286. 1899. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 196. 1903. **Lemmerman.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 625. 1905.

Plate XV. fig. 8, 9.

Plant mass crustaceous, orbicular, up to 1 mm. in thickness, brown becoming black; filaments 6-9 mic. in diameter, very slender, densely coalesced in vertical fascicles; false branches aggregated; sheaths gelatinous, colorless, finally becoming brownish; trichomes 2-3 mic. in diameter, thicker at the apices; cells and heterocysts elongate; hermogones very long; cell contents pale greenish or yellowish brown.

United States. Frequently intermingled with larger algae, on moist rocks, wet earth, etc. (Wolle). **Massachusetts.** Newton. (Farlow). **Mexico.** (Lenormand). **West Indies.** On trees, summit of Trois Pitons (4,500 feet). November, December 1892; on the ground, mostly in old "Diablotia" holes, Morne Anglais (2,300 feet), July 1892; on banks near

summit. Couliabon (3,700 feet), Dominica, January, February 1896. (Elliott). **Hawaii.** (Berggren).

In speaking of *Tolypothrix byssoidea cylindrica* Tilden, Dr. Setchell states that "although the basal stratum and fasciculi of branchlets are not well developed, yet the branches seem to indicate this species (*F. ambigua*) rather than the one to which Miss Tilden has referred it." Further investigation is needed to settle this point.

447. *Fischerella thermalis* (Schabe) Gomont. Note sur le *Scytonema ambiguum* Kuetz. Morot. Journ. de Bot. 9: 52. 1895. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 66. 1887. De Toni. Syll. Algar. 5: 574. 1907.

Farlow, Anderson and Eaton. Algae Am. Bor. Exsicc. no. 223. 1877. (*Scytonema thermale* Borzi). Farlow. Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. (*Fischeria thermalis americana* Farlow). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 211. 1896. Lemmermann. Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 625. 1905. (*Stigonema thermale* (Schabe) Borzi).

Plate XV. fig. 10, 11.

Plant mass .5 mm. in thickness, cushion-shaped, woolly, expanded, blackish olive or blue-green; primary filaments 10-13 mic. in diameter, creeping, interwoven, constricted at joints, very much branched on the upper side; cells somewhat spherical, surrounded by a close, colorless or yellowish sheath; branches 7-9 mic. in diameter, erect, cylindrical, or sometimes inflated and torulose; cells somewhat quadrate, separated; hormogones of three to six cells, showing vacuolar cell contents; sheaths close, continuous; heterocysts intercalary and lateral.

New Hampshire. On stone in damp woods. Shelburne, Lake Willoughby; on granite rocks near Shelburne. (Farlow). **Hawaii.** In hot water. Crater of Kilauea, Hawaii. (Schauinsland).

Var. *mucosa* Lemmermann. l. c. 626. pl. 8. f. 16-18. 1905. De Toni. l. c. 575.

Plate XV. fig. 12.

Filaments 14-21 mic. in diameter, slightly or not at all constricted at joints, almost regularly dichotomously branched; sheaths wide, transparent, mucous, trichomes constricted at the joints; cells quadrate, cylindrical or disc-shaped; apical cell hemispherical, with less granular contents; heterocysts not known; hormogones consisting of four to six cells, filled with vacuoles, surrounded by a gelatinous sheath; protoplasmic contents (in preserved material) spindle-shaped or spherical, in contact with that of adjoining cells by means of protoplasmic threads passing through the transverse walls.

Hawaii. In hot water. Kilauea, Hawaii. (Schauinsland).

Genus **STIGONEMA** Agardh. Syst. Algar. 20. 1824.

Plants terrestrial or aquatic; plant mass rigid, blackish brown, or cushion-like and soft; filaments free, rarely laterally aggregated, scattered; trichomes, in the larger filaments, consisting of two or several rows of cells; heterocysts often lateral, here and there intercalary, hormogones developed in the apices of vegetative branches or in short special branches.

- I Trichomes in the mature filaments consisting usually of a single row of cells
 - 1 Filaments 7-15 mic. in diameter; sheaths usually colorless
S. hormoides
 - 2 Filaments 25 mic. in diameter; cells 14 mic. in diameter, 6-8 mic. in length
S. aerugineum
 - 3 Filaments 24-26 mic. in diameter; sheaths thick, lamellose
S. panniforme
 - 4 Filaments 14-38 mic. in diameter; sheaths yellowish brown
S. tomentosum
 - 5 Filaments 24-45 mic. in diameter; sheaths thick, lamellose, colorless or yellowish brown
S. ocellatum
- II Trichomes in the mature filaments consisting usually of two or several rows of cells
 - 1 Filaments up to 35 mic. in diameter
 - (1) Filaments 18-28 mic. in diameter; cells often surrounded by a special darker colored envelope
S. minutum
 - (2) Filaments 27-37 mic. in diameter; cells throughout the entire length of the filament uniformly divided
S. turfaceum
 - 2 Filaments 40-90 mic. in diameter
 - (1) Hormogones 45 mic. in length, terminal, solitary or in series
S. informe
 - (2) Plants rigid; hormogones 45 mic. in length, lateral
S. mamillosum

Species not well understood

S. brandegeei

448. *Stigonema hormoides* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 68. 1887. De Toni. Syll. Algar. 5: 577. 1907.

West and West. On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 272. 1895. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 6. no. 259. 1897. **West and West.** A Further Contribution to the Freshwater Algae of the West Indies. 1. c. 34: 286. 1899. **Setchell.** Notes on Cyanophyceae.—III. Erythea. 7: 47. 1899. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904.

Plant mass thin, somewhat woolly, brownish black; filaments 7-15

mic. in diameter, 3 decimill. long, decumbent, slender, densely interwoven, irregularly and sparingly branched; branches erect, flexuous, somewhat torulose, equal in diameter to the primary filament; sheaths thick, colorless or yellowish; cells somewhat spherical, loosely arranged in a single row, rarely in two rows; heterocysts scattered; cell contents pale blue-green.

New Hampshire. One of the species composing the brown coating on the wall of the "Flume." (Collins). **Massachusetts.** In gelatinous masses, on dripping rocks. Cascade, Middlesex Fells. April 1896. (Collins). **West Indies.** On trees. Summit of Trois Pitons (4,500 feet); on rocks, Roseau Valley (1,000-2,000 feet), June 1892; abundant on banks, Morne Micotrin; on roadside and on bank near Roseau Lake (2,700 feet); on rocks, Castle Bruce River (2,000-3,000 feet), Dominica, January, February 1896. (Elliott).

Var. *tenue* West and West. l. c. 30: 273. pl. 15. f. 4-8. 1895. De Toni. l. c. 578.

Plate XV. fig. 13.

Filaments more slender, 5.5-7 mic. in diameter.

West Indies. With the typical form but much more abundant. (Elliott).

Var. *rhizodes* (Kuetzing) Hansgirg. Prodrum der Algenflora von Böhmen. 2: 25. 1892. De Toni. l. c. 578.

Wolle. Fresh-Water Algae U. S. 274. 1887.

Plant mass brownish black; filaments 8-12 mic. in diameter; branches unilateral, slightly tapering or thickened at the apices.

Vermont. On moist rocks. Charlotte. (Wolle).

449. *Stigonema aerugineum* n. sp.

Plate XV. fig. 14.

Plant mass forming a brown, membranous layer; filaments 25 mic. in diameter, rounded at apices, rare, mixed with other algae; branches short, straight, spreading; sheaths thick, homogeneous, colorless; cells 14 mic. in diameter, 6-8 mic. in length, oval or depressed globose, crowded, usually forming a single row; heterocysts 8 mic. in diameter, somewhat spherical; cell contents bright blue-green.

Hawaii. Covering bottom of pool. On Puna Road, thirteen miles from Hilo, Hawaii. July 1900. (Tilden).

450. *Stigonema panniforme* (Agardh) Kirchner. Algen Kryptogamen-Flora von Schlesien. 230. 1878. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 71. 1887. De Toni. Syll. Algar. 5: 580. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 73. pl. 9. f. 3. 1872. (*Sirosiphon argillaceus* Wood). **Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 185. 1877; Fresh-Water Algae U. S. 273. pl. 193. f. 12, 13. 1887. **Bennett.** Plants of Rhode Island. 114. 1888. (*Sirosiphon pulvinatus* Bréb.). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **Hauck and Richter.** Phykotheke Universalis. Fasc. 4. no. 645. 1889. **West and West.** On some Freshwater Algae from the West Indies.

Journ. Linn. Soc. Bot. 30: 273. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 2. no. 61. 1895. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905.

Plant mass caespitose, expanded, olive-black; filaments 24-36 mic. in diameter, up to 1 mm. in length, decumbent, flexuous, intricate, tapering at the apices, irregularly branched; branches erect, agglutinated laterally in fascicles, as thick as the primary filament; sheaths thick, yellowish or yellowish-brown, roughened on the surface; cells short, separated, usually in one series; heterocysts scattered; hormogones terminal, 20 mic. in diameter, about 100 mic. in length.

Maine. Growing on rocks and moss just above high water mark, but wet by spray in rough weather. Cape Rosier. July 1894. (Collins). **New Hampshire.** In crevices of rocks. Shelburne. August 1894. (Farlow). **Massachusetts.** Wet rock. Middlesex Fells. (Collins). **Rhode Island.** Pocasset Brook. (Bennett). **Connecticut.** On vertical faces of trap rocks. Sargent's River, Woodbridge. November 1891. (Setchell). On moist rocks. Sage's Ravine, below first falls, Salisbury. October. (Holden). **New Jersey.** Frequent, on moist rocks. (Wolle). **Pennsylvania.** Wet mountain cliff. Pike County. (Wolle). **South Carolina.** On a moist clay bank near Aiken. August 1869. (Ravenel). **West Indies.** On trees. Summit of Trois Pitons (4,500 feet); on rocks, Roseau Valley (1,000-2,000 feet), Dominica. (Elliott).

451. **Stigonema tomentosum** (Kuetzing) Hieronymus. Bemerkungen ueber einige Arten der Gattung Stigonema Ag. Hedwigia. 34: 166. 1895. De Toni. Syll. Algar. 5: 581. 1907.

Wolle. Fresh-Water Algae U. S. 269. pl. 191. f. 1-20; pl. 195. f. 16. 1887. (*Sirosiphon pulvinatus alpinus* (Kg.) Wolle).

Plant mass compact, woolly, up to 2 mm. in height, often cracked, crustaceous, brownish black; filaments 14-38 mic. in diameter; primary filaments decumbent, giving off numerous elongate, erect, flexuous branches; branches often densely agglutinated into fascicles; sheaths yellowish or brownish; trichomes for the most part consisting of a single row of cells rarely of two rows; cells of the older filaments somewhat quadrate or spherical, rarely somewhat cylindrical, each surrounded by a special, deeper colored envelope; cells of the younger filaments 10-12 mic. in diameter, often compressed, wider than long, with blue-green contents; heterocysts not rare, lateral or oftener intercalary, somewhat quadrate or spherical, oftener compressed, wider than long, yellowish; hormogones 10 mic. in diameter, 40-100 mic. in length.

West Virginia. Wet rocks. Black Water Creek. (Wolle).

452. **Stigonema ocellatum** (Dillwyn) Thuret. Essai Class. Nostochinées. 380. 1875. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 69. 1887. De Toni. Syll. Algar. 5: 578. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 36. 1870-1877. (*Sirosiphon pluviale* Crouan). **Wood.** Contr. Hist. Fresh-Water

Algae North America. 69, 71. pl. 8. f. 2, 3. 1872. (*Sirosiphon pellucidulus* Wood, *S. neglectus* Wood). **Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 185. 1877. (*Sirosiphon crameri* Brugg). **Nordstedt.** De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 7. 1878. **Wolle.** Fresh Water Algae. Bull. Torr. Bot. Club. 6: 285. 1879. (*Sirosiphon ocellatus* Kg.) **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Wittrock and Nordstedt.** Algae Aq. Dulc. Exsicc. no. 668. 1883. **Wolle.** Fresh-Water Algae U. S. 272. pl. 194. f. 1-3, 11-16. 1887. **Bennett.** Plants of Rhode Island. 114. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 10. no. 455. 1898. **Setchell.** Notes on Cyanophyceae.—III. Erythea. 7: 48. 1899. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 399. 1901. **Setchell and Gardner.** Algae of North-western America. Univ. Calif. Pub. Bot. 1: 196. 1903. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 625. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 27. no. 1309. 1906. **Tilden.** Notes on a collection of Algae from Guatemala. Proc. Biol. Soc. Wash. 21: 155. 1908; American Algae. Cent. VII. Fasc. 1. no. 626. 1909.

Plate XV. fig. 15-17.

Plant mass caespitose or cushion-like, woolly, brownish; filaments 3-8 mm. long, erect, decumbent at the base, irregularly branched; branches scarcely more slender than the primary filaments, 35-45 mic. in diameter, elongate, straight, spreading, all bearing hormogones; sheaths thick, lamellose, colorless or yellowish brown; trichomes consisting of one, rarely two rows of cells; cells 20-30 mic. in diameter, of various sizes, often wider than long, each surrounded by a special, darker colored envelope; heterocysts rare, lateral; hormogones 15 mic. in diameter, 50-65 mic. in length.

Alaska. On rocks in a rapid stream emptying into Glacier Bay; floating in a quiet freshwater pool, Prince William Sound, June 1899. (Saunders). **New Hampshire.** Common on the wet rocks of the Flume and Berlin Falls. (Farlow). One of the species composing the brown coating on wall of Flume. September 1904; among decaying vegetation on bottom of lake. Lake Chocorua. September 1906. (Collins). **Massachusetts.** Attached to Sedges in freshwater swamp. Falmouth. August 1897. (Moore). **Rhode Island.** Quidnessett. (Bennett). **New York.** Forming, with minute mosses, a blackish, turfy coating to a steep slope of bare rock (5,000 feet), over portions of which water is continually dripping. Near top of Mount Tahawus, Adirondack Mountains. (Wood). **New Jersey.** Forming, with various other species of algae, a gelatinous blue-green or brown stratum; in a very stagnant pool; on submerged sticks in swampy places, "in dark brown waving tufts, about one-half inch in length"; Bamber Lake, 1883. (Wolle). **Florida.** In a marsh pool. Near Hibernia. (Canby). **Central America.** Growing on edges of steam-holes on side of Volcano Santa Maria, near Lake Atitlan. February 1906. (Kellerman). **West Indies.** On

rocks. Castle Bruce River (2,000-3,000 feet), Dominica. January, February 1896. (Elliott). **Hawaii.** In stagnant water. Mauna Kea, Hawaii. (Berggren, Lemmermann).

453. **Stigonema minutum** (Agardh) Hassall. History of the British Fresh-water Algae. 1: 230. pl. 67. f. 3, 4. 1845. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 72. 1887. De Toni. Syll. Algar. 5: 582. 1907.

Wood. Prodromus of a Study of the Freshwater Algae of Eastern North America. 133. 1869; Contr. Hist. Fresh-Water Algae North America. 72, 74. pl. 9. f. 2. 1872. (*Sirosiphon acervatus* Wood, *S. lignicola* Wood). **Wolle.** Fresh-Water Algae U. S. 273. pl. 193. f. I-II. 1887. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30: 273. 1895; A Further Contribution to the Freshwater Algae of the West Indies. 1. c. 34: 286. 1899. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 15. no. 713. 1900. **Saunders.** The Algae. Harri-man Alaska Exped. Proc. Wash. Acad. Sci. 3: 399. 1901. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 197. 1903. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Lemmermann.** Algenfl. Sandwich-Inseln. Bot. Jahrb. 34: 627. 1905.

Plate XV. fig. 18, 19.

Plant mass crustaceous or cushion-like, thin, fragile, blackish; filaments 18-28 mic. in diameter, about 1 mm. in length, decumbent at the base, ascending, flexuously curved, branched; branches sometimes long, similar to the primary filaments, sometimes very short, bearing hormogones, often very much crowded on one side; sheaths yellowish or yellowish brown, lamellose, the special envelope surrounding each cell frequently of a deeper color; trichomes in the basal portion of the filament usually consisting of one row of cells, those in the middle and upper portions often composed of two to four rows; heterocysts numerous, lateral or intercalary; hormogones 12-15 mic. in diameter 25-35 mic. in length.

Alaska. Forming a thin brown coating with *Chroococcus rufescens*, on damp rocks, several hundred feet above sea level. Prince William Sound. (Trelease). **Greenland.** (Börgesen). **New Hampshire.** One of the species composing the brown coating on wall of the Flume. September 1904. (Collins). **Massachusetts.** On wet cliff. Cascade, Melrose. April 1900. (Collins). **Connecticut.** On submerged rocks in Plantain Pond, Salisbury. October. (Holden). **South Carolina.** On old boards. April; on boards over which spring water was constantly running, August; growing on bark of *Ilex opaca*; on old wood and on trunks of trees. (Ravenel); **West Indies.** On damp wall of dam. Sharp's River, St. Vincent; on trees, summit of Trois Pitons (4500 feet); on lime-trees, Shanford Estate; in stream, Wotten Waven, Dominica. (Elliott). **Hawaii.** On gravelly volcanic soil. Hilo, Hawaii. (Berggren, Schauinsland).

Var. **saxicola** (Naegelii) Bornet and Flahault. 1. c. 73. De Toni. 1. c. 584.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 7. 1878. (*Sirosiphon saxicola* Naeg.). **Farlow.** Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Wittrock and Nordstedt.** Algae Aq. Dulc. Fxssicc. no. 669. 1884.

Plant mass usually thin, crustaceous; filaments 15-21 mic. in diameter; sheaths brown or brownish yellow; cells usually compressed, spherical in the primary filaments, short and often dense in the branches, in the apex truncate and forming a single row.

New Hampshire. On exposed rocks and on *Stereocaulon*. Top of Cabot Mountain, Shelburne. (Farlow). **Pennsylvania.** (Wolle). **Hawaii.** On gravelly volcanic soil. Hilo, Hawaii. (Berggren)

454. **Stigonema turfaceum** (Berkeley) Cooke. British Fresh-Water Algae 272. pl. III. f. 2. 1882-1884. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 74. 1887. De Toni. Syll. Algar. 5: 584. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 75. 1872. (*Sirosiphon pulvinatus* Bréb.). **West.** The Freshwater Algae of Maine. Journ. of Bot. 27: 207. 1889. **Richter.** Süßwasseralgen aus dem Umanakdistrikt. Bib. Bot. 7: Heft. 42. 4. 1897.

Plate XV. fig. 20.

Plant mass cushion-like, deep olivaceous black; filaments 27-37 mic. in diameter, up to 1 mm. in length, decumbent at the base, ascending, variously curved, much branched; branches resembling the primary filament, erect, bearing hormogones at the apex; sheaths thick, lamellose, yellowish brown; trichomes consisting of from two to four rows of cells; heterocysts collateral; hormogones 12 mic. in diameter, 45 mic. in length.

Greenland. East coast. Summers of 1892 and 1893. (Vanhöffen). **Maine.** (West). **New Jersey.** Growing on exposed face of rocks. (Austin). **Pennsylvania.** On rocks. Near Philadelphia. (Wood).

Var. parvus Wood. Contr. Hist. Fresh-Water Algae North America. 75. pl. 10. f. 1. 1872. De Toni. l. c. 585.

Filaments closely interwoven into a deep olive black, turfy mass, very thick, irregularly and frequently branched, yellowish brown; branches polymorphous, their apices usually obtusely rounded, containing from one to four rows of cells; sheaths thick, light yellowish brown, sometimes colorless; trichomes consisting usually of several row of cells, cell contents granular, usually deep brown, sometimes light green.

Pennsylvania. On the face of dripping rocks along the Wissahickon Creek, near Philadelphia. (Hunt).

455. **Stigonema informe** Kuetzing. Spec. Algar. 319. 1849. Bornet and Flahault. Revis. des Nostoc. VII. 5: 75. 1887. De Toni. Syll. Algar. 5: 585. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 73. pl. 8. f. 4. 1872. (*Sirosiphon guttula* Wood). **Wolle.** Fresh Water Algae. III.

Bull. Torr. Bot. Club. 6: 185. 1877. (*Sirosiphon coralloides* Kg., *S. lacustris* Rab.); Fresh-Water Algae U. S. 270. pl. 191. f. 21; pl. 192. f. 9-12. 1887. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 605. 1889. **West and West.** On some Freshwater Algae from the West Indies. Journ. Linn. Soc. Bot. 30. 273. 1895. **Setchell.** Notes on Cyanophyceae.—I. *Erythea*. 4: 88. 1896; Notes on Cyanophyceae.—II. *Erythea*. 4: 191. 1896.

Plate XV. fig. 21.

Plant mass expanded, caespitose or crustaceous, somewhat mucous, brownish or black; filaments 40-70 mic. in diameter, 1-2 mm. in length, erect from a decumbent base, irregularly branched; branches 45 mic. in diameter, straight or bent, branched on upper side, all bearing hormogones; sheaths thick, lamellose, yellowish brown; cells 15-18 mic. in diameter; heterocysts numerous, collateral; hormogones 18 mic. in diameter, 45 mic. in length, solitary or in series.

Vermont. Wet rocks. Mt. Mansfield. (Wolle). **Connecticut.** In small quantity in Long Pond, Lantern Hill, Ledyard. (Setchell). **New Jersey.** On stones constantly washed by the waves, along the rocky shores of Green Pond, Morris. (Wolle). On dry rocks and on moist rocks. (Austin.) **South Carolina.** Growing on the bark of *Taxodium distichum*. Aiken. (Ravenel). **West Indies.** On trees. Summit of Trois Pitons (4500 feet). Dominica. (Elliott).

456. **Stigonema mamillosum** (Lyngbye) Agardh. Syst. Algar. 42. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 77. 1887. De Toni. Syll. Algar. 5: 587. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 77. 1872. **Farlow.** Marine Algae New England. 40. 1882; Notes on the Cryptogamic Flora of the White Mountains. Appalachia. 3: 236. 1883. **Collins.** Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 247. 1894; Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 128. 1896. **Collins, Holden and Setchell.** Phy. Bor.-Am. Fasc. 8. no. 356. 1897. **Collins.** Algae of the Flume. Rhodora. 6: 230. 1904; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237, 243. 1905.

Plate XV. fig. 22.

Plant mass cushion-like, woolly, up to 12 mm. in thickness; filaments up to 65 mic. in diameter, erect, rigid, interwoven, very much branched at the base; branches 45-50 mic. in diameter, gradually tapering at the ends, erect, spreading, with numerous branchlets; some branchlets sterile, long and thick, others bearing hormogones, mammilliform, short, spreading, shorter than the diameter of the branch, 24 mic. in diameter; sheaths thick, lamellose, often torulose, yellowish brown; hormogones short, 15 mic. in diameter, 45-50 mic. in length; heterocysts collateral.

Newfoundland. On submerged stones in a pond at the foot of Windsor Lake, near St. John's. July 1897. (Holden). **Maine.** On rocks in outlet of Hadlock Lower Pond. (Holden). **New Hampshire.** On submerged stones

in the Androscoggin River, Shelburne. (Farlow). On rocks just outside the Flume. (Collins). **Massachusetts.** In a brook which empties into the sea at Rafe's Chasm, Magnolia Cove, in Gloucester. (Farlow). On pebbles at margin of Spot Pond, Cascade, Middlesex Fells. (Collins). **Connecticut.** On damp rocks in Mill River, near Samp Mortar Rock; on stones in Pequon-nock River. July. (Holden). **New York.** Round Pond, near West Point. (Bailey).

457. *Sirosiphon brandegeei* Wolle. Fresh-Water Algae U. S. 274. pl. 194. f. 17-27. 1887. De Toni. Syll. Algar. 5: 590. 1907.

Filaments 12-20 mic. in diameter, with somewhat pointed apices, reddish brown; cells in one, two or three rows.

Colorado. On "shores" of a soda spring. Cannon City (Brandegge).

Genus **CAPSOSIRA** Kuetzing. Spec. Algar. 344. 1849.

Plant mass hemispherical, cushion-like, attached by lower surface, formed of filaments growing together laterally, aquatic; filaments erect, branched, composed of a single row of cells; sheaths septate; heterocysts intercalary and lateral; hormogones composed of from 10-20 cells; gonidia spherical; wall of gonidium thick, brownish.

458. *Capsosira brebissonii* Kuetzing. Spec. Algar. 344. 1849. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 5: 79. 1887. De Toni. Syll. Algar. 5: 592. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 427. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 26. 110. 1257. 1905.

Plate XVI. fig. 1.

Plant mass crustaceous-confluent or hemispherical, 1-3 mm. thick, gelatinous, hard, blackish green, within showing concentric zones of green and yellowish tints; filaments 7.5 mic. in diameter, straight, densely crowded, irregularly branched, torulose; branches appressed, close, upright, fastigiate; sheaths thick, gelatinous, not lamellose, colorless or yellowish; cells 4-5 mic. in diameter, somewhat globose, distant; heterocysts lateral.

New Hampshire. On shells. Lake Chocorua. September 1904. (Farlow). **Connecticut.** Growing on a large rock on the eastern side of Round Pond at Lantern Hill, near Mystic. (Setchell).

Genus **NOSTOCHOPSIS** Wood.

Prodr. Fresh-Water Alg. N. A. 126. 1869.

Plant mass or colony gelatinous, definite, aquatic; trichomes formed of a single row of cells, branched; heterocysts intercalary and lateral, pedicellate or sessile.

459. *Nostochopsis lobatus* Wood. Prodromus of a Study of the Fresh-Water Algae of Eastern North America. 127. 1869; Contr. Hist. Fresh-Water Algae North America. 45. pl. 3. f. 6. 1872. Bornet

and Flahault. *Revis. des Nostoc. Ann. Sci. Nat. Bot. VII.* 5: 80. 1887. *De Toni. Syll. Algar.* 5: 592. 1907.

Farlow. *Notes on Fresh-Water Algae. Bot. Gaz.* 8: 225. 1883. Collins, Holden and Setchell. *Phyc. Bor.-Am. Fasc. 3.* no. 110. 1895. Setchell. *Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club.* 22: 427. 1895. Collins. *Phycological Notes of the late Isaac Holden.—II.* *Rhodora.* 7: 237. 1905.

Plate XVI. fig. 2.

Colony vesicular, lobed, up to 2 cm. in diameter, hollow, blue-green or yellowish green; trichomes 4-9 mic. in diameter, 1 mm. in length, branched from the base, loose, elongate, flexuous, often constricted at joints; branches unilateral, fastigiate, cylindrical below, torulose in upper portions, somewhat club-shaped; cells up to twice as long as wide; heterocysts lateral, exserted, or intercalary.

Vermont. Forming expansions of several inches in water courses. Ferrisburg. (Faxon and Hosford). **Connecticut.** Forming irregular, firmly gelatinous balls growing upon stones in more or less rapid water in a brook just west of the "head" of the mountain. Mt. Carmel, about seven miles north of New Haven. September 1893 and 1895. (Setchell). In brook. Mt. Carmel. September. (Holden). **Pennsylvania.** Floating. Schuylkill River, just above Manayunk. (Wood).

Family V. RIVULARIACEAE

Filaments tapering from base to apex, ending in a colorless hair, simple or branched; false branches due to development of new trichome from a cell of the main trichome, usually occurring immediately under an intercalary heterocyst—rarely by the perforation of the sheath between two heterocysts by the trichome, as in *Scytonema*—either separating immediately and forming a new sheath, or remaining for some time within the original sheath; heterocysts usually present, usually basal, occasionally intercalary; reproduction by means of vegetative division, hormogones and gonidia.

I Heterocysts not present

Amphithrix

II Heterocysts present

1 Filaments free, simple or coalesced into a branched plant mass

(1) Sheaths cylindrical

A Filaments simple or branched; false branches distinct, free

Calothrix

B Filaments branched; false branches several (two to six) remaining within the original sheath or common tegument

Dichothrix

C Filaments branched; false branches many (up to a hundred) remaining within the original sheath or common tegument

Polythrix

(2) Sheaths thick, saccate

Sacconema

- 2 Filaments coalesced into a crustaceous, spherical or hemispherical, mucous or gelatinous plant mass or colony

(1) Heterocysts basal

A Filaments simple, parallel, associated in a crustaceous layer
Isactis

B Filaments branched, radially arranged, associated in a spherical or hemispherical colony
Rivularia

(2) Heterocysts intercalary

Brachytrichia

Genus **AMPHITHRIX** Kuetzing. Phyc. Gen. 220. 1843.

Plant mass crustaceous or caespitose, thin, expanded, of a purple or violet color, consisting of two layers: the lower layer composed of densely interwoven filaments or of minute, radiately disposed series of cells; the upper layer consisting of simple erect filaments, closely packed together and tapering to fine points; sheaths thin, close, continuous; hormogones solitary or in series; heterocysts not present.

460. *Amphithrix janthina* (Montagne) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 344. 1886. De Toni. Syll. Algar. 5: 601. 1907.

Collins. Notes on New England Marine Algae.—VI. Bull. Torr. Bot. Club. 23: 2. 1896; Preliminary Lists of New England Plants.—V. Marine Algae, Rhodora. 2: 41. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905.

Plate XVI. fig. 3.

Plant mass crustaceous, thin, purple; filaments 1.5-2.2 mic. in diameter, 3-5 decimill. in length, erect, close, purplish; sheaths thin, uniform, very close; cells equal to the diameter in length; hormogones 20 mic. in length; cell contents pale blue-green.

Massachusetts. On wet cliffs just above high water mark. Rockport. (Collins). **Connecticut.** Coating stones in Island Brook, below R. R. October. (Holden).

Var. *torulosa* (Grunow) Bornet and Flahault. l. c. 344. De Toni. l. c. 601.

Collins. Notes on New England Marine Algae. VI. Bull. Torr. Bot. Club. 23: 2. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 6. no. 262. 1897. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Filaments up to 5 mm. in length; trichomes torulose.

Massachusetts. Forming a purplish coating on stone in ditch in salt marsh near Linden Station, Revere. September 1892. (Collins).

461. *Amphithrix violacea* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 344. 1886. De Toni. Syll. Algar. 5: 602. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 218. 1896.
 Collins. Preliminary Lists of New England Plants.—V. Marine Algae.
 Rhodora. 2:41. 1900; Phycological Notes of the late Isaac Holden.—II.
 Rhodora. 7:223. 1905.

Plate XVI. fig. 4.

Plant mass caespitose, brownish red or violet; filaments 2-3 mic. in diameter, 1-3 mm. in length, erect, fasciculate; sheaths thin, uniform; trichomes constricted at the joints; cells shorter than their diameter; cell contents granular.

Maine. On cliffs at high water mark. Eagle Island, Penobscot Bay. July 1892. (Collins). Rhode Island. (Collins). Connecticut. On stones. Fresh Pond. November. (Holden).

Genus **CALOTHRIX** Agardh. Syst. Algar. 24. 1824.

Plant mass consisting of penicillate tufts or a soft velvety expansion; filaments simple or slightly branched; heterocysts basal or intercalary, absent in a few species; gonidia basal, seriate.

I Heterocysts not present.

C. juliana

II Heterocysts present.

I Plants living in salt water

(1) Heterocysts basal

A Plants fasciculate or penicillate, parasitic

a Filaments 12-15 mic. in diameter

C. confervicola

b Filaments 21-29 mic. in diameter

C. consociata

B Plants caespitose, often growing on rocks

a Filaments 8-12 mic. in diameter; cell contents violet

C. fusco-violacea

b Filaments 10-18 mic. in diameter; cell contents olive green

C. scopulorum

c Filaments 9-15 mic. in diameter; cell contents olive green

C. contarenii

d Filaments 15-20 mic. in diameter; cell contents olive green

C. pulvinata

e Plants parasitic; filaments 9-15 mic. in diameter, thickened into a bulb at the base; cell contents blue-green

C. parasitica

(2) Heterocysts basal and intercalary

A Filaments 9-12 mic. in diameter, scarcely thickened at base

C. aeruginea

B Filaments 15-18 mic. in diameter; false branches solitary

C. prolifera

C Filaments 12-21 mic. in diameter; false branches fasciculate at the apex of the filament

C. fasciculata

- D Filaments 12-24 mic. in diameter; false branches in pairs, arising between two heterocysts *C. vivipara*
- E Filaments 10-40 mic. in diameter, interwoven at base, decumbent *C. pilosa*
- F Filaments 12-40 mic. in diameter, not branched; sheaths yellowish brown *C. crustacea*
- 2 Plants living in fresh water
- (1) Plants epiphytic
- A Filaments 5-7.5 mic. in diameter; trichomes 3.4-4 mic. in diameter *C. epiphytica*
- B Filaments 7-8 mic. in diameter; heterocysts basal, usually in pairs *C. scytonemicola*
- C Filaments 8-10 mic. in diameter; trichomes 6-9 mic. in diameter, especially constricted at joints; heterocysts basal, in pairs *C. stagnalis*
- D Filaments 10-12 mic. in diameter, curved and bulbous-inflated at the base; trichomes 7-8 mic. in diameter *C. fusca*
- E Filaments 5-15 mic. in diameter, sometimes thicker at the base; trichomes 3.5-5.5 mic. in diameter *C. sandwicensis*
- F Filaments 15-16 mic. in diameter at base; sheaths thick, lamellose, finally becoming brownish black; cells very short *C. breviarticulata*
- G Filaments 15-18 mic. in diameter; sheaths wide, often truncate, almost colorless; trichomes 7-9 mic. in diameter *C. violacea*
- H Filaments 18-24 mic. in diameter; sheaths thick, gelatinous, lamellose, finally ocreate *C. adscendens*
- (2) Plants living in warm or hot water
- A Filaments 8-10 mic. in diameter; sheaths somewhat thick, uniform, transparent, sometimes yellowish at base; heterocysts basal, rarely intercalary *C. thermalis*
- B Filaments 8-10 mic. in diameter; sheaths close, ocreate, transparent, becoming yellowish brown; heterocysts basal and intercalary, spherical or quadrate *C. calida*
- C Filaments 10-11 mic. in diameter; sheaths close, thick, lamellose, ocreate, transparent and yellowish *C. kuntzei*
- (3) Plants living on stones and wood
- A Filaments 9-10 mic. in diameter; sheaths narrow, close, uniform, colorless; trichomes 6-7 mic. in diameter *C. braunii*
- B Filaments 10-12 mic. in diameter; sheaths thick, close, uniform or ocreate, yellowish brown *C. parietina*
- C Filaments 12-13 mic. in diameter; sheaths thin, close, uniform, colorless or yellowish *C. castellii*

Species not well understood

C. donnellii
M. elongatum
M. fertile
M. fibrosum
M. halos
C. lacucola
S. obscurus
M. paradoxum
C. rhizosoleniae
M. sejunctum
M. turgida

462. *Calothrix juliana* (Meneghini) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 348. 1886. De Toni. Syll. Algar. 5: 605. 1907.

Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 425. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 3. 1895. Tilden. American Algae. Century II. no. 163. 1896. Collins. The Algae of Jamaica. Proc. Am. Acad. 37: 241. 1901. Brown. Algal periodicity in certain ponds and streams. Bull. Torr. Bot. Club. 35: 247. 1908.

Plate XVI. fig. 5.

Filaments scattered or forming an interrupted, olivaceous layer, densely crowded, erect, simple, rigid, often thickened at the base, 10-15 mic. in diameter, 2 mm. in length; sheaths thin, close, not lamellose, colorless; trichomes 9-12.5 mic. in diameter, ending in a long, tapering, fragile hair; cells three times shorter than their diameter; hormogones 4 or 5 times longer than their diameter.

United States. (Farlow). **Massachusetts.** Massopoag Brook, Sharon. (Setchell). **Connecticut.** Growing on wood and on stones. Trading Cove Brook, Norwich; Quinebaug River, Lisbon. (Setchell). Forming small isolated blackish tufts (1-3 mm. in diameter), on smooth stones in shallow water. Trading Cove Brook, Norwich. September 1892. (Setchell). **Indiana.** Bloomington. (Brown). **California.** On stones in stream. Pasadena. January 1896. (McClatchie). **West Indies.** On stones in stream. Roaring River, St. Ann's Bay, Jamaica. March 1893. (Humphrey).

463. *Calothrix confervicola* (Roth) Agardh. Syst. Algar. 70. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 349. 1886. De Toni. Syll. Algar. 5: 606. 1907.

Harvey. Nereis Boreali-Americana. Part III. 105. 1858. Farlow. List Marine Algae United States. Proc. Am. Acad. Arts Sci. 10: 380. 1875. Hall. List of the Marine Algae growing in Long Island Sound within 20 miles of New Haven. Bull. Torr. Bot. Club. 6: 112. 1876. Farlow. Marine Algae of New England. 36. pl. 1. f. 6. 1881. Pike. Check List of Marine

Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Bennett.** Plants of Rhode Island. 95. 1888. **Collins.** Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888; Marine Algae of Nantucket. 5. 1888; Algae of Middlesex County. 13. 1888. **Martindale.** Marine Algae of the New Jersey coast and adjacent waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 602. 1889. **Anderson.** List of California Marine Algae, with notes. Zoe. 2: 218. 1891. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 9. 1895. **Collins.** Preliminary lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900; The Algae of Jamaica. Proc. Am. Acad. 37: 241. 1901. **Lemmerman, E.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 627. 1905. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905.

Plate XVI. fig. 6-8.

Filaments gregarious, stellately fasciculate, attached to larger algae, rigid, not thickened at the base, blackish green or lead-colored, 12-25 mic. in diameter, 2-3 mm. in length; sheaths close, very often entirely colorless, sometimes yellowish brown in lower parts, homogeneous, soft, gelatinous in upper portions; trichomes 10-18 mic. in diameter; cells four or five times shorter than their diameter; heterocysts one or two, basal; hormogones numerous in the sheath, four to six times longer than their diameter.

Canada. On other algae. Malpeque, Prince Edward Island. (Faull). **New England.** On algae of all kinds. Very common in summer. (Farlow). **Maine.** (Collins). **New Hampshire.** (Collins). **Massachusetts.** On *Enteromorpha intestinalis* in ditches in salt marshes. Wood's Hole. July 1892. (Setchell). "Parasitic" on various algae at Brant Point; on *Ulva* in salt water, Medford, Everett. (Collins). **Rhode Island.** On the filiform marine algae. (Bailey, Olney, Hunt). **Connecticut.** On *Ruppia*, Fresh Pond, August. (Holden). **New York.** Shores of Long Island. In fresh and salt water. Bay Ridge, Fort Hamilton. Summer. Staten Island. (Pike). **New Jersey.** On rockweed. Atlantic City. (Morse, Martindale). Hudson: Hoboken and Communipaw. (Pike). New York Bay. (Hooper). **California.** Common. (Anderson). **West Indies.** On various algae. Port Antonio. Jamaica. March 1893. (Humphrey). **Hawaii.** On marine algae. Laysan. 1896-1897. (Schauinsland).

Var. *purpurea* Bornet and Flahault. l. c. 350. De Toni. l. c. 607.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 30. no. 1456. 1908.

Trichomes purple.

Maine. On *Cladophora expansa* (Kuetz). In marsh pools. Stover's Point. Harpswell. 13 July 1905. (Collins).

464. *Calothrix consociata* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 351. 1886. De Toni. Syll. Algar. 5: 607. 1907.

Setchell and Gardner. Algae of Northwestern University. Univ. Calif. Pub. Bot. 1: 197. 1903.

Plate XVI. fig. 9.

Filaments gregarious and stellately fasciculate, attached to filiform alga, curved, decumbent and slightly thickened at the base, blackish green, 21-29 mic. in diameter, .5 mm. in length; sheaths close, membranaceous, brownish, with dilated, funnel-shaped apex, the outside layers colorless; trichomes 12 mic. in diameter; cells three times shorter than the diameter; heterocysts basal; cell contents olive.

Washington. On grasses in a salt marsh. Head of Penn's Cove, near Coupeville, Whidbey Island. (Gardner).

465. *Calothrix fusco-violacea* Crouan in herb. Thuret and Mus. Paris. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 352. 1886. De Toni. Syll. Algar. 5: 608. 1907.

Setchell. Notes on Cyanophyceae.—I. Erythea. 4: 87. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 5. no. 217. 1896. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Plate XVI. fig. 10.

Filaments 8-12 mic. in diameter, .5 mm. in length, gregarious, forming a velvety, indefinite or violet mass, bent and thickened at the base; sheaths close, thin, colorless, uniform, gelatinous and diffuent in upper parts; trichomes 7-8 mic. in diameter, constricted at joints, at first ending in a short hair which falls off when hormogones are formed, leaving apex truncate; cells shorter than their diameter; heterocysts basal, often worn out; hormogones many within the sheath, up to ten times longer than their diameter.

Massachusetts. Forming orbicular velvety patches, reddish purple to dark blue-green in color, on *Punctaria plantaginea*. Wood's Hole. Summer of 1895. (Nott).

466. *Calothrix scopulorum* (Weber and Mohr) Agardh. Syst. Algar. 70. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 353. 1886. De Toni. Syll. Algar. 5: 608. 1907.

Harvey. Nereis Boreali-Americana. Part III. 105. 1858. **Farlow.** List Marine Algae United States. Proc. Am. Acad. Arts Sci. 10: 380. 1875. **Kjellman.** Algae of the Arctic Sea. 322. 1883. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. **Collins.** Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. **Bennett.** Plants of Rhode Island. 95. 1888. **Martindale.** Marine Algae of the New Jersey coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. **Collins.** Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 246. 1894. **Rosenvinge.** Les Algues Marines du Groenland. Ann. Sci. Nat. Bot. VII. 19: 162. 1894; Deuxième Mémoire, sur les Algues marines du Groenland. Medd. om Groenland. 20: 121. 1898. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 399. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 17. no. 805. 1901. **Setchell and Gard-**

ner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 197. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223, 243. 1905. **Börgesen and Jonsson.** The Distribution of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic. Bot. Faeroes. App. XXV. 1905.

Plate XVI. fig. 11, 12.

Plant mass caespitose, velvety, widely expanded, dark green or olive; filaments 10-18 mic. in diameter, up to 1 mm. in length, twisted and curled, moderately thickened at the base; sheaths somewhat thick, colorless, yellowish brown, or forming yellowish and colorless zones, lamellose in the larger filaments, variously dilated and expanded; trichomes 8-15 mic. in diameter, ending in a hair; heterocysts one to three, basal; hormogones numerous in the sheath, four or five times longer than their diameter.

Greenland. Forming "in conjunction with several other algae, a thin stratum over stones within the upper part of the littoral zone. It is scarce here (in the Polar Sea), and nowhere occurs in great masses. It has been found both on exposed and sheltered coasts." Greenland Sea; West coast of Spitzbergen. (Kjellman). Forming a gelatinous cushion upon rocks in the littoral region. (Sorenson). East and west portions. (Börgesen and Jonsson). **Newfoundland.** On rocks between tides. Quidi Vidi. July 1897. (Holden). **Maine.** Very common on rocks. Seal Harbor; Little Cranberry Isle (Collins); Sea Wall (Holden). **New Hampshire.** (Collins). **Massachusetts.** On rocks near high water mark. Marblehead. June 1901. (Collins). **Rhode Island.** Rocks near high water mark. (Bailey and Olney). **Connecticut.** On rocks. Stratford Shoals. July, September. (Holden). **New York.** Shores of Long Island. Greenport, Little Egg Harbor. Summer. (Pike). Staten Island. (Pike). **New Jersey.** Hoboken, Beesley's Point. (Pike). On wharves. Atlantic City. (Morse, Martindale). On woodwork. (Morse). **New Jersey.** Marine. Hudson; Hoboken; Cape May; Beesley's Point. (Pike). On wharves, Atlantic City. (Morse). **Washington.** In salt water. Puget Sound. (Saunders).

467. **Calothrix contarenii** (Zanardini) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 355. 1886. De Toni. Syll. Algae. 5: 610. 1907.

Collins. Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 335. 1891; The Algae of Jamaica. Proc. Am. Acad. 37: 241. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1113. 1903.

Plate XVI. fig. 13.

Plant mass crustaceous, compact, orbicular, smooth, glistening, blackish green; filaments 9-15 mic. in diameter, up to 1 mm. in length, very densely crowded, parallel, erect, moderately flexuous; decumbent and thickened at the base; sheaths somewhat thick, colorless or yellowish, dilated into lamellose, funnel-shaped expansions; trichomes 6-8 mic. in diameter, ending in a slender long hair; cells equal to or shorter than their diameter; heterocysts, one to two, basal.

Massachusetts. On stones more or less embedded in the sand, a little above low water mark. Revere Beach. January and February. (Collins). **West Indies.** On wreck on beach. Port Morant, Jamaica. March 1893. (Humphrey). On *Galaxaura*, etc. Santurce, Porto Rico. May 1903. (Howe).

468. *Calothrix pulvinata* (Mertens) Agardh. Syst. Algar. 71. 1824. Borner and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. 3: 356. 1886. De Toni. Syll. Algar. 5: 610. 1907.

Farlow. Marine Algae of New England. 37. 1881. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 106. 1886. **Collins.** Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. **Bennett.** Plants of Rhode Island. 95. 1888. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. **Collins.** Algae. Rand and Redfield's Flora of Mount Desert Island, Maine. 247. 1894; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 20. no. 957. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 197. 1903. **Collins.** Notes on Algae.—V. Rhodora. 5: 208. 1903; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905.

Plate XVI. fig. 14.

Plant mass sponge-like, porous, fasciculate, hairy on the surface, dull green, widely expanded; filaments 15-18 mic. in diameter, 2-3 mm. in length, erect, flexuous, scarcely thickened at the base, agglutinated into irregular fascicles, sparingly branched; branches often opposite; sheaths thick, firm, lamellose, colorless or brownish; trichomes 8-12 mic. in diameter, tapering into a short hair; cells two or three times shorter than their diameter; hormogones four to six times longer than broad, often developed within the sheath; cell contents olive.

Maine. Growing in extensive sheets on beams and posts under old tide mill. Harpswell. July 1902; on piles of bridge, outlet of Long Pond. "Rare; the most northern station for this species yet reported." (Collins). **Massachusetts.** On wharves. Wood's Hole. (Farlow). **Rhode Island.** Newport. (Farlow). **Connecticut.** On woodwork at or above high water mark. Black Rock; Stratford Shoals; on old hulk, Cook's Point, August, October. (Holden). **New York.** Shores of Long Island: Greenport, Little Egg Harbor. (Pike). **New Jersey.** On wharves. Atlantic City. (Morse, Martindale). **Washington.** In salt marsh on sticks and old wood. Whidbey Island. August 1899. (Gardner).

469. *Calothrix parasitica* (Chauvin) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 381. 1875. Borner and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 357. 1886. De Toni. Syll. Algar. 5: 612. 1907.

Farlow. Marine Algae of New England. 37. 1881. **Collins.** Notes on New England Marine Algae. II. Bull. Torr. Bot. Club. 10: 55. 1883. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 106. 1886. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 3. no. 111. 1895. **Setchell.**

Notes on Cyanophyceae.—III. *Erythea*. 7: 46. 1899. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. *Rhodora*. 2: 41. 1900; Phycological Notes of the late Isaac Holden.—II. *Rhodora*. 7: 223. 1905.

Plate XVI. fig. 15, 16.

Filaments 9-15 mic. in diameter, .5 mm. in length; gregarious, immersed in the outer cells of *Nemalion*, blue-green, bulbous and curved at the base (bulb up to 24 mic. in diameter); sheaths thin, colorless, often dilated and funnel-shaped at the apex; trichomes 7-8 mic. in diameter, ending in a very long, flexuous hair; cells short; heterocysts basal; hormogones many in the sheath, four or five times longer than the diameter.

Maine. (Collins). **New Hampshire.** (Collins). **Massachusetts.** Completely covering *Nemalion multifidum* growing at low water mark between the Oak Bluff and the Camp Meeting landings, at Cottage City. (Collins). Epiphytic on the fronds of *Nemalion multifidum*. Wood's Holl. July 1895. (Nott). **Rhode Island.** On *Nemalion*. Newport. (Farlow). **Connecticut.** On *Nemalion*. Stratford Shoals. July. (Holden).

470. *Calothrix aeruginea* (Kuetzing) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 10. 1875. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 358. 1886. De Toni. Syll. Algar. 5: 612. 1907.

Schramm and Mazé. Essai Class. Algues Guadeloupe. 30. 1865. (*Leibleinia flaccida* Crouan). **Mazé and Schramm.** Essai Class. Algues Guadeloupe. 20. 1870-1877. (*Lyngbya nemalionis* Crouan). **Collins.** Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 336. 1891; Preliminary Lists of New England Plants. V. Marine Algae. *Rhodora*. 2: 41. 1900; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 241. 1901. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 17. no. 804. 1901. **Collins.** Phycological Notes of the late Isaac Holden.—II. *Rhodora*. 7: 223. 1905. **Vickers.** Liste des Algues Marines de la Barbade. Ann. Sci. Nat. Bot. VIII. 1: 55. 1905. **Börgesen and Jonsson.** The Distribution of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic. Botany of the Faeroes. Appendix. XXV. 1905.

Plate XVII. fig. 1.

Filaments 9-12 mic. in diameter, .5 mm. in length, forming a somewhat continuous light blue-green layer on the surfaces of larger algae, decumbent and slightly thickened at the base; sheaths somewhat thick, very often entirely colorless, rarely yellowish in lower parts, uniform, soft, and gelatinous in the upper portions; trichomes 7-9 mic. in diameter, ending in a gradually tapering hair; cells short; heterocysts one or two at the base, few or none intercalary, hormogones numerous within the sheath, four to six times longer than wide.

Maine. Cape Rosier. July 1890; among other algae on woodwork of old wharf, Otter Creek, Mount Desert Island. July 1900. (Collins). **Massachusetts.** (Collins). **Connecticut.** Forming a coating on iron piles between tide marks. Black Rock Beacon. August, October. (Holden). **West Indies.** On *Dasya arbuscula*. Montego Bay, Jamaica. June 1900.

(Pease and Butler). Rocky Bay, Hastings, Barbados. (Vickers). **Hawaii.** Growing on other algae. In pools at half tide. Waianae, Waikiki and Laie Point, Oahu. May and June 1900. (Tilden).

471. *Calothrix prolifera* Flahault in Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 361. 1886. De Toni. Syll. Algar. 5: 615. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1168. 1904. (*Calothrix crustacea* forma *prolifera* (Flah.) Collins). **Collins.** New species, etc., issued in the Phycotheca Boreali-Americana. Rhodora. 8: 105. 1906.

Plant mass expanded, velvety, brownish green; filaments 15-18 mic. in diameter, 2 mm. in length, somewhat flexuous, curved and distinctly thickened at the base, here and there branched; branches issuing in the region of the heterocyst as in *Tolypothrix*; sheaths thick, lamellose, firm, colorless in upper portions, yellowish below, ocreate; ocreae dilated and torn; trichomes 8-12 mic. in diameter, tapering at the apex into a hair; cells three or four times shorter than their diameter; heterocysts one or two at the base, many scattered through the trichome.

California. Among other algae, on boards wet with salt water. Alameda. January 1904. (Gardner).

472. *Calothrix fasciculata* Agardh. Syst. Algar. 71. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 361. 1886. De Toni. Syll. Algar. 5: 615. 1907.

Collins. Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 336. 1891. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 6. no. 261. 1897. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Plant mass caespitose, velvety, expanded, blackish green; filaments 12-21 mic. in diameter, 2-3 mm. in length, erect, somewhat flexuous, a little thickened at the base, when young unbranched, later branched; false branches formed in two ways: sometimes scattered and lateral, solitary or in pairs, sometimes fasciculately crowded on one side of the middle portion of the filament; sheaths moderately thick, lamellose, firm, uniform or dilated, colorless or with age becoming yellowish brown; trichomes 8-12 mic. in diameter, ending in a hair; cells two or three times shorter than the diameter; heterocysts basal and, in mature filaments, few or numerous throughout the trichome; cell contents blue-green.

Maine. On rocks between tide marks. Cape Rosier. July 1889; on dead shells, Cape Rosier, July 1895. (Collins). **Massachusetts.** (Collins). **Rhode Island.** (Collins).

Forma *incrustans* Collins. Notes on Algae.—I. Rhodora. 1: 13. 1899. De Toni. l. c. 616.

Collins. Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 336. 1891. (*C. contarenii* Collins). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 561. 1899. Collins. Notes on Algae.—II. Rhodora. 1: 13. 1900; Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Plant mass crustaceous, flattened; filaments 8-12 mic. in diameter, more slender than in the typical form.

Massachusetts. On rocks in littoral zone. Revere Beach. September 1895. (Collins).

473. *Calothrix vivipara* Harvey. Nereis Boreali-Americana. Part III. 106. 1858. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 362. 1886. De Toni. Syll. Algar. 5: 616. 1907.

Farlow. List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875; Marine Algae of New England. 37. 1881. Wittrock and Nordstedt. Algae Aq. Dulc. Exsicc. no. 1307. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 560. 1899. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Plant mass widely expanded, velvety, blackish green; filaments 12-24 mic. in diameter, 3-5 mm. in length, decumbent and interwoven at the base, becoming erect, somewhat flexuous, branched; false branches in pairs, issuing from the filament as in *Scytonema*; sheaths thick, gelatinous, uniform, yellowish brown, somewhat opaque; trichomes 9-15 mic. in diameter, tapering very gradually from base to apex, ending in a hair; cells equal to or shorter than their diameter; heterocysts basal and a few scattered through the trichome; cell contents olive green.

Massachusetts. Forming patches on rocks and growing also on other algae. Nahant; Wood's Holl. (Farlow). In upper tide pools on smooth rocks. Marblehead. August 1895. (Collins). **Rhode Island.** (Bailey). Seaconnet Point. (Farlow).

474. *Calothrix pilosa* Harvey. Nereis Boreali-Americana. Part III. 106. pl. 48 C. 1858. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 363. 1886. De Toni. Syll. Algar. 5: 614. 1907.

Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (*Scytonema submarinum* Crn.). Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 18. no. 859. 1901. Collins. The Algae of Jamaica. Proc. Am. Acad. 37: 242. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 24. no. 1167. 1904.

Plant mass caespitose, widely expanded, black or dark blue-green; filaments 10-40 mic. in diameter, 2-10 mm. in length, decumbent and interwoven at the base, erect at the apices, elongate, rigid, free or growing together laterally in fascicles, distinctly thicker in upper portions; sheaths hard, thick, at first orange, finally yellowish brown, opaque, uniform; trichomes 10-20 mic. in diameter, briefly tapering at the apex; terminating in a hemispherical cell, here and there interrupted by heterocysts; cell contents olive brown.

Florida. Forming blackish or dark brown, pilose strata of indefinite extent. On rocks between tide marks. Key West. (Harvey). **California.** Forming a black velvety covering on the bottoms of small pools in the rocks above high water mark, but filled with salt water from the spray and higher waves, though often much concentrated by the sun. Near Point Carmel, Monterey County. June 1901. (Setchell). **West Indies.** Guadeloupe. (Mazé). On *Bostrychia tenella*. Port Antonio, Jamaica.

August 1894. (Pease and Butler). On rocks, etc., littoral. Porto Rico. May 1903. (Howe).

475. *Calothrix crustacea* Thuret. Notes Algologiques. 1: 13. pl. 4. 1878. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 359. 1886. De Toni. Syll. Algar. 5: 613. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 31. 1870-1877. Farlow, Anderson and Eaton. Algae Am. Bor. Exsicc. no. 49. 1877. Farlow. Marine Algae of New England. 36. 1881. Pike. Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 105. 1886. Collins. Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888; Algae of Middlesex County. 13. 1888; Marine Algae of Nantucket. 5. 1888. Bennett. Plants of Rhode Island. 95. 1888. Martindale. Marine Algae of the New Jersey coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 602. 1889. Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. (Schizosiphon pilosus Crn.). Anderson. List of California Marine Algae, with Notes. Zoe. 2: 218. 1891. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 1. no. 10. 1895. Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900. Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 197. 1903. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 25. no. 1212. 1905. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 223. 1905.

Plate XVII. fig. 2-6.

Plant mass caespitose, velvety, widely expanded, blackish green or brownish; filaments 12-40 mic. in diameter, 1-2 mm. in length, erect, densely crowded, a little thickened at the base; sheaths somewhat thick, colorless or yellowish brown, in the older filaments lamellöse, variously dilated and expanded in upper portions; trichomes 8-15 mic. in diameter, ending in a long hair; cells short; heterocysts one to three at the base, often many scattered through the trichome; hormogones many within the sheath, four or five times longer than wide; gonidia oblong, cylindrical, smooth, in series.

Canada. On other algae. Malpeque, Prince Edward Island. (Faull). Maine. (Collins). New Hampshire. (Collins). Massachusetts. On *Ulva* in salt water. Medford; Everett; Brant Point and Polpis. (Collins). On algae of all kinds and on rocks. Wood's Holl. (Farlow). Rhode Island. Narragansett Bay. (Bennett). (Collins). Connecticut. Clothing fronds of *Cladophora*, *Enteromorpha* and other algae, also on rocks. Woodmont. July 1892; on algae and rocks, Stratford Shoals; Cook's Point, July, September, October. (Holden). New York. Shores of Long Island: Bay Ridge, Fort Hamilton. Summer. (Pike). New Jersey. On rockweed. Atlantic Ocean. (Morse, Martindale). Florida. (Harvey, Melville). Washington. Floating, on rocks, clay banks, wood, etc., in brackish lagoon. Whidbey Island; Keyport, Kitsap County. (Gardner). California. Common. On rocks, wharves and other algae. (Anderson). On grass and weeds, salt marsh. Alameda. April 1904. (Gardner). West

Indies. Guadeloupe. (Mazé). **Hawaii.** On other algae. In tide pools at half tide. Waianae, Oahu. May 1900. (Tilden).

Forma *simulans* Collins in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 29. no. 1406. 1907.

Filaments stout; color from light blue-green to purple or dull rose.

Massachusetts. On *Zostera*. Mattapoisett. October 1906. Appearing like *C. confervicola* (Roth) Ag., but with intercalary heterocysts. (Collins).

476. *Calothrix epiphytica* West and West. Welwitsch's African Freshwater Algae. Journ. of Bot. 35: 240. 1897. De Toni. Syll. Algar. 5: 621. 1907.

West and West. Journ. Linn. Soc. Bot. 34: 285. 1898-1900.

Filaments 5-7.5 mic. in diameter at the base, 250 mic. rarely up to 350 mic. in length, minute, attached to larger algae, solitary or somewhat gregarious, gradually tapering from base to apex; sheaths somewhat thick, transparent and colorless; trichomes 3.5-4 mic. in diameter at the base, ending in a very thin hair at the apex; cells equal to the diameter, in length, or at the base a little shorter; heterocysts basal, solitary, small.

West Indies. Epiphytic on *Tolypothrix*. Dominica. (Elliott).

477. *Calothrix scytonemicola* n. sp.

Plate XVII. fig. 7.

Filaments 7-8 mic. in diameter, isolated or in small groups, the lower portion attached to host, the remainder erect and free, ending in a hair point; sheaths not distinct; heterocysts 8 mic. in diameter, basal, usually two in number, somewhat globose.

Hawaii. Growing on filaments of *Scytonema crispum*. Very abundant. In stagnant water in pool on beach, among roots of Water hyacinth. Meheiva, Makao, Koolauloa, Oahu. June 1900. (Tilden).

478. *Calothrix stagnalis* Gomont. Note sur un *Calothrix* sporifère. (*Calothrix stagnalis* sp. n.). Morot. Journ. de Bot. 9: 197. f. 1, 2. 1895. De Toni. Syll. Algar. 5: 619. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 23. no. 1114. 1903. Collins. Notes on Algae.—VII. Rhodora. 8: 123. 1906.

Plate XVII. fig. 8, 9.

Filaments 8-10 mic. in diameter in the middle portions, up to 1 mm. in length, gregarious, radiating, decumbent and thickened at the base, erect, sickle-shaped; sheaths thin, close, papery, transparent; trichomes 6-9 mic. in diameter, especially constricted at joints, gradually tapering into a hair; cells 6-10 mic. in diameter, unequal, usually subquadrate or longer than the diameter; heterocysts in pairs, basal, yellowish, spherical or somewhat quadrate; gonidia 10-11 mic. in width (with sheath 12-14 mic. wide), 26-40 mfc. in length, yellowish; wall of gonidium smooth.

Massachusetts. In stellate tufts, rather sparsely distributed on various filamentous algae, in swamp. Medford. August 1903. (Collins).

479. *Calothrix fusca* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 364. 1886. De Toni. Syll. Algar. 5: 617. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 31. 1877. (*Mastigotherix longissima* Crouan). **Wolle.** Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Mastigonema fusca* Wolle). Fresh Water Algae III. Bull. Torr. Bot. Club. 6: 184. 1877. (*Mastigotherix aeruginosa* Kuetz. **Bennett.** Plants of Rhode Island. 114. 1888. (*Mastigonema aeruginosum* (Kg.) Kirchn.). **Collins.** Algae of Middlesex County. 13. 1888. (*Mastigonema aeruginosum* Kirchn.). **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1893. Minn. Bot. Studies. 1: 30. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 11. 1895. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the Metropolitan Park Commission, Massachusetts. 127. 1896. **Collins.** The Algae of Jamaica. Proc. Am. Acad. 37: 241. 1901. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 399. 1901. **Snow.** The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 197. 1903. **Collins.** The Algae of the Flume. Rhodora. 6: 230. 1904. **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 627. 1905. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 29. no. 1407. 1907.

Plate XVII. fig. 10, 11.

Filaments 10-12 mic. in diameter, 2-3 decimill. in length, scattered or gregarious, living within the colonies of gelatinous algae, curved and bulbous-inflated at the base (bulb 15 mic. in diameter); sheaths thick, colorless, gelatinous, diffuent at the apex; trichomes 7-8 mic. in diameter, ending in a long hair; cells short; heterocysts one or two at the base.

Alaska. Embedded in the gelatinous coating of *Batrachospermum vagum* from a freshwater pond. Cook Inlet; Kadiak Island. (Saunders). Occurring singly or few together in the jelly of other species of algae. Near Iliuliuk, Unalaska. (Setchell and Lawson). **New Hampshire.** On *Batrachospermum vagum*. Lake Chocorua. September 1906; on wall of Flume. (Collins). **Massachusetts.** On *Batrachospermum*. Billerica. (Faxon). Among other algae on rocks at Cascade, Middlesex Fells. (Collins). **Rhode Island.** Easton's Pond, Newport. (Bennett). **Connecticut.** On *Batrachospermum vagum*. Pool below Factory Pond Dam. October. (Holden). **New Jersey.** October 1892. (Peters). **Pennsylvania.** (Wolle). **Ohio.** In plankton. Lake Erie. Put-in-Bay. (Snow). **Minnesota.** In pool near Lake Kilpatrick. June 1893. (Ballard). **West Indies.** Guadeloupe. (Conquérant). **Hawaii.** In ditches between Honolulu and Waikiki, Oahu. 1896-1897. (Schauinsland).

480. *Calothrix sandvicensis* (Nordstedt) Schmidle. Zur Entwicklung einer Zygnuma und Calothrix. Flora. 84: 170. pl. 5. f. 12-14. 1897. De Toni. Syll. Algar. 5: 618. 1907.

Nordstedt. De Algis Aquae Dulcis et de Characeis ex Insulis Sandvicensibus a Sv. Berggren 1875 reportatis. 5. pl. 1. f. 3. 1878. (*Lophopodium sandvicense* Nordst.). **Lemmermann.** Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 627. 1905.

Plate XVII. fig. 12.

Filaments 5-15 mic. in diameter, sometimes thickened in lower portion; trichomes 3.5-5.5 mic. in diameter; heterocysts equal to or exceeding the basal cells in diameter; gonidia 8 mic. in diameter, 8-10 mic. in length, single, rarely in pairs, somewhat quadrate, angular-convex, rotund.

Hawaii. On filaments of *Pithophora affinis*. Near Hilo, Hawaii. July 1889. (Lauterbach).

481. *Calothrix breviarticulata* West and West. Welwitsch's African Freshwater Algae. Journ. of Bot. 35: 240. 1897. De Toni. Syll. Algar. 5: 620. 1907.

West. West Indian Freshwater Algae. Journ. of Bot. 42: 293. 1904.

Filaments 15-16 mic. at the base, 11.5-12.5 mic. in middle portions, up to 380 mic. in length, solitary or gregarious, gradually tapering from base to apex; sheaths thick, lamellose, becoming brownish black in old plants; trichomes 8.5 mic. in diameter at the base, 5.5-7.5 mic. in middle portions; cells disc-shaped, four or five times shorter than their diameter; heterocysts solitary, basal, hemispherical; cell contents pale blue-green.

West Indies. Epiphytic on *Vaucheria* species. Royal Botanical Gardens, St. Ann's, Trinidad. (Howard).

482. *Calothrix violacea* (Wolle) De Toni. Syll. Algar. 5: 619. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Mastigonema violacea* Wolle).

Filaments 15-18 mic. in diameter, parasitic, usually in clusters, ten or twelve arising from each base, "a sort of warty excrescence," when young blue-green, changing when mature to purplish iron or amethyst color, finally becoming olivaceous brown; sheaths wide, often truncate, almost colorless; trichomes 7-9 mic. in diameter; lower cells short, two or four times shorter than the diameter, upper cells longer, finally four or six times as long as wide; heterocysts more or less compressed.

Pennsylvania. "Parasitic on *Plectonema* in shallow river waters." (Wolle).

483. *Calothrix adscendens* (Naegeli) Bornet and Flahault. Revis. des Noctoc. Ann. Sci. Nat. Bot. VII. 3: 365. 1886. De Toni. Syll. Algar. 5: 620. 1907.

Wolle. Algae Exsicc. no. 83. (*Mastigonema parasiticum* Wolle). **Setchell.** Notes on Cyanophyceae. III. Erythea. 7: 46. 1899.

Plate XVII. fig. 13-14.

Filaments 18-24 mic. in diameter, 1 mm. in length, scattered or gregarious, light blue-green in dried material, tapering from base to apex; sheaths thick, gelatinous, lamellose, finally becoming ocreate, transparent; trichomes 12 mic. in diameter in the middle portions; cells equal to the diameter in length or shorter; heterocysts basal.

Pennsylvania(?). (Wolle).

484. *Calothrix thermalis* (Schwabe) Hansgirg. Beiträge zur Kenntniss der Böhmisch. Thermalalgenflora. Oesterr. Bot. Zeitschrift. 34: 279. 1884. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 368. 1886. De Toni. Syll. Algar. 5: 625. 1907.

Weed. Formation of Travertine and Silicious Sinter by the Vegetation of Hot Springs. U. S. Geol. Survey. 9th Ann. Report. 665. 1889. (*Mastigonema thermale* Schwabe). **Tilden.** American Algae. Cent. III. no. 287. 1898. Observations on some West American Thermal Algae. Bot. Gaz. 25: 94. pl. 9. f. 1-5. 1898.

Plate XVIII. fig. 1-5.

Plant mass mucous, smooth, more or less expanded, deep olive green, when dried blue-green; filaments 8-10 mic. in diameter, up to 3 mm. in length, interwoven, flexuous, densely crowded; sheaths somewhat thick, uniform, transparent, sometimes yellowish at the base; trichomes 5-8 mic. in diameter, tapering at the apex into a long hair, here and there constricted at the joints; cells equal to or three times shorter than the diameter; heterocysts basal and rarely intercalary.

Wyoming. Olive colored, forming sinter. Crater of Excelsior Geyser; overflow of channel of geyser, temperature 49-54.5° C., Spasmodic Geyser; forming cedar-colored fur on overflow channel of Old Faithful Geyser, Upper Basin, 1897. (Weed). With other algae in rivulets. Temperature 49-50° C. Fountain Hotel Geyser Basin. June 1896; very common in colder portions of overflows, temperature 34° C., Emerald Pool, Upper Geyser Basin, July 1896, Yellowstone National Park. (Tilden).

485. *Calothrix calida* P. Richter in Kuntze. Revisio Generum Plantarum. Part III. II. 388. f. a, b. 1898. De Toni. Syll. Algar. 5: 626. 1907.

Plate XVIII. pl. 6, 7.

Plant mass 6 mm. in thickness, dry, spongy or crustaceous, widely expanded, flattened, olivaceous; filaments 8-10 mic. in diameter, interwoven flexuous, aggregated; sheaths close, yellowish brown, when young transparent, thick, ocreate here and there dilated; trichomes 3-6 mic. in diameter, pale blue-green, tapering into a long hair; cells spherical or elliptical, equal to their diameter, or three times longer, the lower ones spherical depressed or barrel-shaped; transverse walls often inconspicuous; heterocysts basal and intercalary, spherical or quadrate.

Wyoming. In warm water from a geyser. Temperature +50° R. 1874. Yellowstone National Park. (Kuntze).

486. *Calothrix kuntzei* P. Richter in Kuntze. Revisio Generum Plantarum. Part III. II. 388. f. a-c. 1898. De Toni. Syll. Algar. 5: 625. 1907.

Plant mass dry, crustaceous, pulvinate, mammillose, stony, expanded, faded within, blue-green on the surface, lamellose, up to 5 mm. in thickness; filaments 10-11 mic. in diameter, free, usually agglutinated in irregular fascicles, parallel or flexible; sheaths close, thick, transparent and yellowish, lamellose, ocreate; trichomes thickened at the base, especially when young, bright bluish in color; basal cells hemispherical or spherical, barrel-shaped or disc-shaped, those in upper portion of trichome oval or spheri-

cal, somewhat quadrate or shorter or longer than their diameter; basal heterocysts spherical; intercalary heterocysts quadrate or cylindrical, sometimes in series, equalling the diameter in length, or up to seven times longer than wide.

Plate XVIII. fig. 8-10.

Wyoming. In running, hot geyser water. October 1874. Yellowstone National Park. (Kuntze).

487. *Calothrix braunii* Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 368. 1886. De Toni. Syll. Algar. 5: 624. 1907.

Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 426. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 3. no. 112. 1895. **Tilden.** American Algae. Century III. no. 286. 1898. **Setchell.** Notes on Cyanophyceae.—III. Erythea. 46. 1899. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 198. 1903. **Collins.** Phycological Notes of the late Isaac Holden. —II. Rhodora. 7: 237. 1905.

Plate XVIII. fig. 11.

Plant mass caespitose, velvety, blue-green; filaments 9-10 mic. in diameter, .5 mm. in length, densely crowded, parallel, straight, curved and thickened at the base; sheaths narrow, close, uniform, colorless; trichomes 6-7 mic. in diameter, equal, tapering into a very long hair, often constricted at joints; cells a little shorter than their diameter; heterocysts basal.

Massachusetts. Growing on stones in a small brook. Sharon; forming extended patches on rounded stones in a small rivulet, Cataumet. (Setchell). **Connecticut.** On stones in shallow water. Bridgeport. October 1893; forming a coating on stones, side stream of Pequonnock River, below Factory Pond Dam, October. (Holden). **Washington.** On dead floating stems of *Scirpus*. Lake Washington, Seattle. July 1897; on pebbles at edge of Lake Union, Seattle, June 1897. (Tilden).

488. *Calothrix parietina* (Naegeli) Thuret. Essai Class. Nostochinées. Ann. Sci. Nat. Bot. VI. 1: 381. 1875. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 366. 1886. De Toni. Syll. Algar. 5: 621. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Mastigonema caespitosum* Kg.); Fresh Water Algae. I. c. 6: 284. 1879, (*Schizosiphon crustiformis* Naeg.). **Farlow.** Marine Algae of New England. 40. 1881. **Wolle.** Fresh-Water Algae U. S. 237, 245. pl. 173. f. 2, 3; pl. 176. f. 5; pl. 178. f. 1-3; pl. 205. f. 6, 7. 1887. (*Calothrix gracilis* Rab., *Isactis caespitosa* (Kg.) Wolle, including *f. tenuior viridis* Rab.). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 12. 1895. **Tilden.** American Algae. Cent. I. no. 65. 1894. (*Porphrysiphon notarisii* Kg.). Cent. II. no. 164. 1896. **Collins.** Algae. Flora of the Blue Hills, Middlesex Fells, Stony Brook and Beaver Brook Reservations of the

Metropolitan Park Commission, Massachusetts. 127. 1896. **Richter**. Süswasseralgen aus dem Umanakdistrikt. Bib. Bot. 7: Heft. 42. 4. 1897. **Tilden**. List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 27. 1898. **Setchell**. Notes on Cyanophyceae. III. Erythea. 7: 45. 1899. **Setchell and Gardner**. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 198. 1903. **Collins**. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 237. 1905. **Collins, Holden and Setchell**. Phyc. Bor.-Am. Fasc. 28. no. 1360. 1907. **Brown**. Algal Periodicity in certain Ponds and Streams. Bull. Torr. Bot. Club. 35: 243, 248. 1908. **Buchanan**. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 15. 1908.

Plate XVIII. fig. 12.

Filaments 10-12 mic. in diameter, up to 1 mm. in length, scattered or aggregated into a crustaceous, thin, brown or black mass, erect or decumbent, flexuously contorted, uniform or somewhat thicker at the base; sheaths close, somewhat thick, yellowish brown, opaque, fragile, sometimes uniform, sometimes ocreate; ocreae wide and fringed in upper portions; trichomes 5-10 mic. in diameter, ending in a thin hair 1 mic. in diameter; cells short, two or three times wider than long; heterocysts a little wider at the base, intercalary heterocysts rare; hormogones few in the sheath, three times longer than wide.

Alaska. Forming reddish brown patches on dripping rocks. Amaknak Cave, Amaknak Island, Bay of Unalaska. (Setchell and Lawson). **Greenland**. Umanak. (Richter). **Vermont**. Northern part. (Wolle). **Massachusetts**. In Nobska Pond, near Wood's Hole. (Farlow). Forming minute tufts on rocks near Bear's Den, Middlesex Fells. (Collins). **Rhode Island**. Forming a calcareous incrustation on perpendicular walls of a limestone quarry. Lincoln. April 1906. (Collins). **Connecticut**. On stone dam of Factory Pond; on dripping rocks between Canaan and Twin Lakes, Salisbury; on dripping rock, East Rock, New Haven; on sandy ground, shore of Fresh Pond, October, November; forming a close coating on stone work of dam, Pequonnock River, Bridgeport, October 1892. (Holden). **New Jersey**. On submerged stones in shallow water. (Wolle). **Indiana**. Abundant on stones in Stone Spring Branch the entire year. Bloomington. (Brown). **Minnesota**. Growing in damp sand in stone quarry. Minneapolis. August 1894. (Anderson). On stone sides of fountain. Kenwood, Minneapolis. August 1895. (Tilden). **Iowa**. On stem of *Phragmites*. Ontario. (Buchanan). **Colorado**. Wet rocks. Cannon City. (Brandegge). **California**. On the sides of a water trough near Berkeley. July 1905. (Osterhout and Gardner). On clay bank of a small stream. North Berkeley. September 1905; on the sides of a water tank, Berkeley, February 1906. (Gardner).

Dr. Setchell considers the specimen under the name of *Calothrix thermalis*, in Tilden. Am. Alg. no. 287, to belong to *C. parietina*. This scarcely seems possible.

"*C. parietina* may be entirely free from incrustation, or it may be very thoroughly incrustated with either lime or silica. It is seldom, if ever, branched, but the hormogonia in the incrustated specimens attach themselves

very often to the sheaths of the older filaments and resemble branches very strongly indeed. Intercalary heterocysts do occur in *C. parietina*, but they are not at all common. The species is usually readily distinguished by its lamellose, brown and more or less ochreate sheath, but these characters may be at times more or less obscure."—Setchell.

489. *Calothrix castellii* (A. Massalongo) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 369. 1886. De Toni. Syll. Algar. 5: 627. 1907.

Wolle. Fresh-Water Algae U. S. 255. pl. 182. f. 8-10; pl. 184. f. 35, 38-40; 187. f. 3-33. (*Scytonema castellii* Mass.); 262. pl. 189. f. 1. 1887.

Plant mass spongy, cushion-shaped, widely expanded, the surface pubescent or hirsute by the projecting ends of the filaments, dull blue-green; filaments 12-13 mic. in diameter, 4-8 mm. in length, curved, flexuous, densely crowded, sometimes agglutinated, erect, decumbent and bulbous at the base; sheaths thin, close, firm, uniform, transparent or yellowish; trichomes 8-10 mic. in diameter, tapering into a very long hair; cells two to four times shorter than their diameter; heterocysts basal.

Pennsylvania. On shelves, walls and flower pots in greenhouse. Harrisburg. (Wolle).

490. *Calothrix donnellii* (Wolle) De Toni. Syll. Algar. 5: 629. 1907. Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 283. 1879. (*Mastigonema donnellii* Wolle).

Plant mass caespitose, mucous, olivaceous; filaments 6-12 mic. in diameter, at the base sometimes 15-20 mic. in diameter, simple or branched, flagelliform; very gradually tapering, sometimes thin and flaccid, sometimes strong and rigid, slightly curved, densely interwoven; sheaths very thin, colorless, at first drawn out into a hair, afterwards often truncate and open; trichomes frequently interrupted; cells usually four or five times shorter than their diameter; transverse walls distinct; heterocysts basal, rarely intercalary; cell contents pale or bright blue-green, sometimes brownish.

Pennsylvania? On wood in salt water, submerged. (Wolle).

491. *Mastigonema elongatum* Wood. Contr. Hist. Fresh-Water Algae North America. 53. pl. 5. f. 1. 1872. Wolle. Fresh-Water Algae U. S. 243. pl. 174. f. 9. 1887. De Toni. Syll. Algar. 5: 631. 1907.

Plant mass at first somewhat spherical, afterwards frequently spindle-shaped, slippery, firm, blackish green; filaments up to 6 mic. in diameter, very elongate, sometimes truncate at the apex, but generally produced into a long, flexuous, translucent hair; sheaths close, transparent, frequently truncate at the apex; trichomes sometimes strongly constricted at joints; cells short; transverse walls sometimes not visible; heterocysts somewhat spherical.

Pennsylvania. On brook moss in an aquarium. (Wood).

492. *Mastigonema fertile* Wood. Contr. Hist. Fresh-Water Algae North America. 54. pl. 5. f. 3. 1872. Wolle. Fresh-Water Algae U. S. 244. 1887. De Toni. Syll. Algar. 5: 630. 1907.

Plant mass caespitose; filaments up to 14 mic. in diameter, elongate, flexuously curved, not branched, truncate at the apex; sheaths moderately close, firm, thick, colorless, with truncate and open apex; trichomes often interrupted; cells three to five times as long as their diameter; transverse walls sometimes distinct, sometimes inconspicuous; heterocysts spherical or compressed, about as wide as the trichome; gonidia up to 4 mic. in diameter, cylindrical, often many in series in one filament; cell contents green.

Pennsylvania. In a stagnant pool in "Bear Meadows," forming a filamentous, felty mass with other algae. Allegheny Mountains, Centre County. (Wood).

493. *Mastigonema fibrosum* (Wood) Wolle. Fresh-Water Algae U. S. 244. pl. 174. f. 8. 1887. Wood. Contr. Hist. Fresh-Water Algae North America. 54. pl. 5. f. 3. 1827. De Toni. Syll. Algar. 5: 631. 1907.

Plant mass light bluish green or olive; filaments 10-11 mic. in diameter, with apex prolonged into a long, hyaline hair; sheaths transparent, in the immature filament distally broad and distinct, although hyaline, below rather thick and close, in the mature filament below close, indistinct, above dissolved in fibrillae and wanting at the apex; transverse walls distinct; heterocysts spherical, sometimes in pairs.

Pennsylvania. In a thick jelly, with other algae, on wet dripping rocks. Near Manayunk. (Wood).

494. *Mastigonema halos* Wood. Contr. Hist. Fresh-Water Algae North America. 52. pl. 5. f. 2. 1872. De Toni. Syll. Algar. 5: 630. 1907.

Plant mass caespitose; filaments up to 12 mic. in diameter, unbranched, in mature state greatly elongate and with the sheath truncate and open, in the young condition shorter and often ending in a rather short hair; sheaths firm, rather thick, often distinctly lamellose, colorless; trichomes 7 mic. in diameter, continuous or interrupted; cells short; heterocysts somewhat spherical; cell contents finely granular.

Connecticut. Growing in little tufts in salt or brackish water. Stonington Inlet. (Wood).

495. *Calothrix lacucola* Wolle. Fresh Water Algae. V. Bull. Torr. Bot. Club. 8: 39. 1881; Fresh-Water Algae U. S. 239. pl. 172. f. 1. 1887. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. De Toni. Syll. Algar. 5: 629. 1907.

Plate XVIII. fig. 13.

Plant mass floating, dull yellow or brownish; filaments 15-20 mic. in diameter at the base, very much branched; false branches somewhat spreading, not concrete, moderately tapering, with obtuse, slightly bent apices, elongate, interwoven; sheaths close, colorless or yellowish; trichomes thin, homogeneous or with distinct transverse walls; cells equal to or two or three times shorter than their diameter; heterocysts spherical, usually single at the base of the branches, equalling the trichome in diameter.

New Jersey. Split Rock Pond, Morris. (Wolle).

496. *Schizosiphon obscurus* Dickie. Notes on some Algae found in the North Atlantic Ocean. Journ. Linn. Soc. Bot. 11: 459. f. 5. 1871. De Toni. Syll. Algar. 5: 633. 1907.

Plate XVIII. fig. 14.

Filaments straight, gradually tapering upwards from the large, somewhat spherical basal cell (heterocyst?); sheaths distinct, obscurely lamellose; trichomes shorter than the sheath, usually torulose throughout.

West Indies ?. Forming a thin stratum on drift wood. (Mitchell). "The contents of the bottle were collected in the North Atlantic on the 24th of November, 1867. * * * Considering our position, I concluded that the substance must have come from some part of the American continent or the West Indies within the influence of the Gulf Stream."—Dickie.

497. *Mastigonema paradoxum* Kuetzing. Phyc. Gen. 233. pl. 5. f. 3. 1843. De Toni. Syll. Algar. 5: 632. 1907.

Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 184. 1877.

. Plate XVIII. fig. 15.

Filaments somewhat solitary; sheaths wide, colorless or yellowish brown, transparent, homogeneous; trichomes up to 13 mic. in diameter, simple or sometimes branched, often moniliform, flaccid or flexuously curved, long; heterocysts spherical, two to four times shorter than the diameter of the trichome.

Pennsylvania. On wet sides of wooden water box. (Wolle).

498. *Calothrix rhizosoleniae* Lemmermann. Planktonalg. in Ergebn. ein Reise n. d. Pacific. 355. 1899. De Toni. Syll. Algar. 5: 630. 1907.

Lemmermann. Algenfl. Sandwich.-Inseln. Bot. Jahrb. 34: 627. pl. 7. f. 2, 3. 1905.

Filaments up to 3 mic. in diameter, slightly thickened at the base, slightly tapering at the apex; sheaths transparent, close; trichomes 2.5 mic. in diameter; cells 1.5 mic. in length.

Hawaii. In plankton on *Rhizosolenia* and *Hemiaulus delicatulus* Lemm. Between Hawaii and Laysan. 1896-1897. (Schauinsland).

499. *Mastigonema sejunctum* Wood. Contr. Hist. Fresh-Water Algae North America. 53. pl. 4. f. 2. 1872. De Toni. Syll. Algar. 5: 631. 1907.

Plant mass somewhat caespitose, soft, parasitic; filaments unbranched, tapering at the apex; sheaths usually wide and distinct, hyaline, often strongly undulate, the apex mostly much amplified and dissolved into fibrillae; trichomes continuous or more rarely interrupted; cells short or long; cell contents granular, yellowish olive or greenish; heterocysts about equal to the filament in diameter.

Michigan. In bog growing on edges of minute leaves so as to form little prominences or thickenings of the margin.

500. *Mastigothrix turgida* Wolle. Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 184. 1877. De Toni. Syll. Algar. 5: 632. 1907.

Filaments 15-20 mic. in diameter at the base, swollen, often curved; trichomes elongated into a colorless, transparent, pointed hair, with long cells; cells in basal portion of trichome somewhat quadrate, becoming when old three or four times shorter than the diameter; cell contents at first blue-green, later violet or yellowish; heterocysts compressed spherical or concave-convex.

Pennsylvania. Scattered, or in small clusters, in gelatinous coatings on submerged timbers. (Wolle).

Genus **DICHOTHRIX** Zanardini.
Plant. Maris Rubri Enum. 89. 1858.

Plant mass caespitose, penicillate or pulvinate; filaments more or less dichotomously branched; trichomes often several (two to six) enclosed within the original sheath or common tegument; heterocysts sometimes basal, sometimes intercalary, in one species not present.

I Plants living in fresh water.

1 Sheaths close, gradually tapering at the apex

- (1) Plants living in hot water; filaments 15-25 mic. in diameter, trichomes 5-6 mic. in diameter D. montana
- (2) Filaments 10-12 mic. in diameter, flexuous, erect, radiating D. orsiniana
- (3) Plant mass encrusted with calcium carbonate; filaments 9-12.5 mic. in diameter, prostrate, not rigid D. calcarea
- (4) Plants living in fresh or rarely salt water; filaments about 15 mic. in diameter; trichomes 5-9 mic. in diameter, constricted at joints D. baueriana
- (5) Filaments 12-15 mic. in diameter; trichomes 10-15 mic. in diameter, not constricted at joints D. olivacea

2 Sheaths lamellose, funnel-shaped at apex

- (1) Filaments 9-12 mic. in diameter; trichomes 6 mic. in diameter D. compacta
- (2) Filaments 13 mic. in diameter; trichomes 6.5-7.5 mic. in diameter D. meneghiniana
- (3) Plant mass usually encrusted with calcium carbonate; filaments 15-18 mic. in diameter; trichomes 6-8 mic. in diameter D. gypsophila
- (4) Filaments 25-28 mic. in diameter; trichomes 10-12 mic. in diameter, bulbously inflated at the bases of the branches; heterocysts light blue in color D. hosfordii

II Plants living in salt water.

- 1 Filaments 15-22 mic. in diameter; trichomes 7-9 mic. in diameter; heterocysts basal D. rupicola
- 2 Filaments 20-30 mic. in diameter; trichomes 17-22 mic. in diameter; heterocysts basal and intercalary D. fucicola

- 3 Filaments 25-35 mic. in diameter; trichomes 15 mic. in diameter; heterocysts oblong, solitary **D. penicillata**
- 4 Filaments 22-30 mic. in diameter; trichomes 7.5-12.5 mic. in diameter; heterocysts basal and intercalary **D. utahensis**

501. *Dichothrix montana* Tilden. American Algae. Cent. VI. no. 572. 1902. De Toni. Syll. Algar. 645. 1907.

Plant mass expanded, blue-green; filaments 15-25 mic. in diameter; sheaths hyaline; trichomes 5-6 mic. in diameter, sometimes constricted at joints, drawn out into a long hair; cells quadrate or longer than their diameter; heterocysts hemispherical.

Montana. On rocks in hot water. Lo Lo Hot springs, Lo Lo. September 1898. (Griffiths).

The plant closely resembles *D. baueriana*, but its filaments are much wider and its habitat quite different. Being very plainly a *Dichothrix*, it cannot be included under *Calothrix thermalis*, and it is therefore made a new species.

502. *Dichothrix orsiniana* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 376. 1886. De Toni. Syll. Algar. 5: 641. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Mastigonema orsinianum* Kg.); 6: 284. 1879. (*Sch. cataractae* Naeg.); Fresh-Water Algae U. S. 236. pl. 168. f. 1, 2. 1887. (*Calothrix orsiniana* Thur.). **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1895. Minn. Bot. Studies. 1: 599. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 9. no. 405. 1898. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 238. 1905.

Plate XVIII. fig. 16.

Plant mass caespitose, made up of penicillate fascicles 2-3 mm. in height, gelatinous, dark green; filaments 10-12 mic. in diameter (in ultimate branches), flexuous, erect, radiating; false branches appressed, enclosed for some distance in a common tegument; sheaths thick, close, soft, uniform, yellow, in lower portions becoming brownish and somewhat opaque; trichomes 6-7.5 mic. in diameter, tapering into a hair; cells shorter than their diameter; cell contents olive green; heterocysts basal.

Connecticut. Forming gelatinous tufts on rocks at the base of a dam. Pequonnock River, Bridgeport. July 1894. (Holden). **New York.** On rocks in rapids of Niagara River, Niagara Falls. (Wolle). **Florida.** (Wolle). **Minnesota.** Kenwood, Minneapolis. August 1895. (Tilden).

503. *Dichothrix calcarea* Tilden. American Algae. Cent. II. no. 165. 1896. De Toni. Syll. Algar. 5: 645. 1907; Some New Species of Minnesota Algae which live in a Calcareous or Silicious Matrix. Bot. Gaz. 23: 100. pl. 9. f. 1-3. 1897; List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 27. 1898. MacMillan. Minnesota Plant Life. 30, 41. f. 8, 10. 1899.

Plate XVIII. fig. 17.

Forming extended strata either on surface of calcareous matrix, giving it a pinkish brown or pale blue-green tinge, or in layers throughout the matrix; filaments 9-12.5 mic. in diameter, prostrate, not rigid; false branches appressed; sheaths rather thin, not lamellose, hyaline; trichomes up to 10 mic. in diameter, for the most part constricted at joints in lower portions, tapering to a hair point; cells in lower portion of filament equal in length to their diameter, shorter in upper portions; heterocysts basal, spherical or depressed, equal to or a little smaller than the diameter of the filament.

Minnesota. Together with *Chaetophora calcarea*, *Lyngbya martensiana calcarea* and *L. nana*, forming the lime encrustation which covers sides of wooden tank. Minneapolis. October 1895. (Tilden).

504. *Dichothrix baueriana* (Grunow) Bornet and Flahault. Revis. des Nostoc. VII. 3: 375. 1886. De Toni. Syll. Algar. 5: 640. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 284. 1879. (*Schizosiphon bauerianum* Grun.). **Setchell.** Notes on Cyanophyceae. —I. Erythea. 4: 88. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 5. no. 216. 1896. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 198. 1903. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 24. no. 1169. 1904.

Plate XVIII. fig. 18.

Filaments 15 mic. in diameter (in ultimate branches), caespitose-penicillate or forming a widely expanded layer up to a centimeter in thickness, flexuous; sheaths close, gelatinous, soft, uniform, transparent or yellowish; trichomes 5-9 mic. in diameter, constricted at joints, gradually tapering into a long hair; cells shorter than or equal to their diameter; cell contents green or brown; heterocysts somewhat spherical or hemispherical.

Alaska. On dripping rocks or stones in running or quiet water. Near Iliuliuk, Unalaska. (Setchell and Lawson). Orca. (Jepson). **Rhode Island.** Forming an uninterrupted coating on submerged limestone rocks in quiet water. Lime Rock. October 1894. (Osterhout). On stones at border of lily pond. Newport. **Connecticut.** Round Pond, Lantern Hill, Ledyard; on stones about edges of lake, Lake Whitney, in Hamden, near New Haven. (Setchell). **Florida.** On submerged wood. (Smith). **Washington.** Whatcom. (Gardner). **West Indies.** On rocks, littoral. Porto Rico. May 1903. (Howe). "The present specimens appear to be the first recorded from a strictly marine station."—Collins.

505. *Dichothrix olivacea* (Hooker) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 375. 1886. De Toni. Syll. Algar. 5: 639. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 36. 1877. (*Calothrix submarina* Crouan). **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

Plant mass caespitose, erect, pulvinately expanded, olive or black; filaments 12-15 mic. in diameter (in the ultimate branches), up to 2 cm. in length, slightly flexuous; false branches very long, equal; sheaths close, thin, uniform, hyaline or yellowish; trichomes 10-15 mic. in diameter, not constricted at joints, tapering into a hair; cells quadrate or longer than their diameter; cell contents blue-green or olive; heterocysts basal, often in pairs.

West Indies. Guadeloupe. (Mazé).

506. *Dichothrix compacta* (Agardh?) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 378. 1886. De Toni. Syll. Algar. 5. 643. 1907.

Setchell. Notes on Cyanophyceae.—III. Erythea. 7: 45. 1899.

Plant mass caespitose; filaments 9-12 mic. in diameter, up to 1 mm. in length, very densely aggregated, erect, penicillate; the upper false branches appressed, often included, for some distance within the common tegument; sheaths lamellose, smooth, uniform or ocreate, orange becoming brownish; ocreae dilated and torn at the apex; trichomes 6 mic. in diameter, ending in a hair at the apex; cells as long as broad, or half as long; cell contents pale olive; heterocysts basal.

California. San Bernardino. (Parish).

"*Dichothrix compacta* (Ag.) B. and F. is not always readily to be distinguished from *D. gypsophila*. It is said to resemble *Calothrix parietina* in every way except that it has the branching of the genus *Dichothrix*. It is shorter than *D. gypsophila*, and has the cells of the trichome usually shorter, rather than longer, than broad. * * * The sheaths are yellowish-brown, lamellose, more or less dilated towards the summit, but, at the very summit, are usually contracted again very suddenly."—Setchell.

507. *Dichothrix meneghiniana* (Kuetzing) De Toni. Syll. Algar. 5: 641. 1907.

Wolle. Fresh Water Algae. Bull. Torr. Bot. Club. 6: 284. 1879. (*Schizosiphon meneghinianus* Kuetz.); Fresh-Water Algae U. S. 238. pl. 170. f. 5-7. 1887. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. (*Calothrix meneghiniana* Kirchn.).

Plate XIX. fig. 1.

Plant mass composed of small deep blue-green or green dense tufts; filaments 13 mic. in diameter, short, simple in the beginning, later much and compactly branched; sheaths distinctly lamellose, yellow or brown in lower portions, colorless and torn into fine fibres at the apices; trichomes 6.5-7.5 mic. in diameter; cells somewhat quadrate, or twice as short as the diameter; heterocysts usually single, about as large as the cells.

New Jersey. Frequent on submerged wood in fresh water. (Wolle).
Florida. Forming a gelatinous stratum on old wet wood. (Smith).

508. *Dichothrix gypsophila* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 377. 1886. De Toni. Syll. Algar. 5: 642. 1907.

Wolle. Fresh-Water Algae U. S. 237. pl. 168. f. 5. 1887. (*Calothrix gypsophila* Kg.). Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. Weed. Formation of Travertine and Silicious Sinter by the Vegetation of Hot Springs. U. S. Geol. Survey. 9th Ann. Report. 665. 1889. Setchell. Notes on Cyanophyceae.—I. Erythea. 4: 88. 1896. Tilden. American Algae. Cent. II. no. 200 B. 1896. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 12. no. 562. 1899. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 238. 1905.

Plate XIX. fig. 2.

Filaments caespitose, scattered or forming a somewhat continuous layer, very often "nestling" among filaments of *Hypheotrichum* and *Leptotrichum*, and encrusted with calcium carbonate (calareous tufa), 15-18 mic. in diameter (in the ultimate branches), about 2 mm. in length, erect, penicillate; upper false branches appressed, included within the common tegument; sheaths thick, lamellose, smooth, orange becoming brown, finally opaque, ocreate; ocreae dilated, truncate, and torn at the apices; trichomes 6-8 mic. in diameter, gradually tapering into a hair; cells equal to or a little longer than the diameter; cell contents green or olive.

Connecticut. Forming gelatinous yellow masses upon rocks and small stones about the edge of Long Pond, at Lantern Hill, in Ledyard. September 1892. (Setchell). Incrusted on limestone, shore of Housatonic River, near Gaylordsville. October 1898. (Holden). **New Jersey.** Fresh Water. Morris; rocky shores of Lake Hopatcong. (Wolle). **Florida.** Adams Key. July 1895. (Curtiss.) **Wyoming.** Forming a finely fibrous sinter, consisting of layers one-sixteenth of an inch to half an inch thick, each stratum resembling a very fine thick white fur. In overflow channels of geysers. Upper Geyser Basin, Yellowstone National Park. (Weed). Taken from wall of Excelsior crater. Weed affirms that it is due "to the growth of the little alga—*Calothrix gypsophila*—or the young form, *Mastigonea thermale*." Middle Geyser Basin, Yellowstone National Park. June 1896. (Tilden).

509. *Dichothrix hosfordii* (Wolle) Bornet in Setchell. Notes on Cyanophyceae.—II. Erythea. 4: 190. 1896. Wolle. Fresh-Water Algae. V. Bull. Torr. Bot. Club. 8: 38. 1881. (*Calothrix hosfordii* Wolle); Fresh-Water Algae U. S. 239. pl. 169. f. 1-4; pl. 170. f. 3, 4. 1887.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 5. no. 215. 1896. Collins. Some Perforating and other Algae on Fresh-Water Shells. Erythea. 5: 96. 1897; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 238. 1905. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 29. no. 1408. 1907.

Plate XIX. fig. 3.

Plant mass olivaceous; filaments 25-28 mic. in diameter; sheaths wide, distinctly lamellose, yellow towards the base, colorless and hyaline towards the end; trichomes 10-12 mic. in diameter, aggregated, subdichotomously branched, bulbously inflated at the bases of the branches; branches flagelliform, tapering to a fine, colorless hair point; cells four or five times shorter than their diameter; heterocysts depressed hemispherical ("skull-cap" shaped), light blue in color.

Vermont. Charlotte. (Hosford). **Massachusetts.** On pebbles. Shores of Pranker's Pond, Saugus. September 1893; epiphytic on flowering plants in shallow water, Herring Pond, Eastham, August 1907. (Collins). **Connecticut.** On smooth red sandstone in running water. Wintergreen Falls, Hampden, near New Haven. November 1891. (Setchell). On stones on border of pool below Factory Pond, Pequonnock River. June, July, October, November. Bridgeport. (Holden). Growing on outside surface of Union shells. Twin Lakes, Salisbury, Litchfield County. (Setchell and Holden). **New York.** Growing upon submerged stones. Lake George. October 1892. (Jellyffe). **Michigan.** Ann Arbor. (Johnson).

510. *Dichothrix rupicola* Collins. Notes on Algae.—IV. Rhodora. 3: 290. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 20. no. 958. 1902. De Toni. Syll. Algar. 5: 644. 1907.

Plant mass caespitose, 1 mm. in thickness; filaments 15-22 mic. in diameter, erect, penicillate, branched; ultimate branches flexuous, divaricate, acute; sheaths lamellose, yellow brown with dilated and lacerate ocreation near the tip; trichomes 7-9 mic. in diameter, terminating in a hair; cells about equal to the diameter in length; heterocysts basal; cell contents blue-green to pale olive.

Maine. Forming a coating on sloping rocks, exposed to the full force of the surf. Pemaquid Point. July 1901. (Collins).

511. *Dichothrix fucicola* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 379. 1886. De Toni. Syll. Algar. 5: 644. 1907.

Mazé and Schramm. Essai Class. Algues Guadeloupe. 32. 1877. (*Matichonema sargassi* Crouan). **Murray.** Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889.

Plant mass caespitose, made up of penicillate, olive green fascicles, 5-8 mm. in height; filaments 20-30 mic. in diameter (in the ultimate branches), erect, rigid; false branches appressed, strict, fastigiate, included for some distance within the common tegument; sheaths close, thin, uniform, hyaline or yellowish; trichomes 17-22 mic. in diameter, ending in a long hair; upper cells quadrate or one-half as long as wide, lower cells two or three times longer than wide; cell contents pale green; heterocysts basal and intercalary.

West Indies. Guadeloupe. (Mazé).

512. *Dichothrix penicillata* Zanardini. *Plantarum Maris Rubri Enumeratio*. 89. pl. 12. f. 3. 1858. Bornet and Flahault. *Revis. des Nostoc. Ann. Sci. Nat. Bot.* VII. 3: 379. 1886. De Toni. *Syll. Algar.* 5: 644. 1907.

Collins, Holden and Setchell. *Phyc. Bor.-Am. Fasc.* 2. no. 62. 1895.
Collins. *The Algae of Jamaica. Proc. Am. Acad. Arts Sci.* 37: 242. 1901.
Collins, Holden and Setchell. *Phyc. Bor.-Am. Fasc.* 23. no. 1112. 1903.

Plant mass caespitose, fastigate-penicillate, scattered or gregarious, dark green; filaments 25-35 mic. in diameter, (in ultimate branches), 2 mm. in length, short, flexuous; sheaths thick, gelatinous, soft, uniform, hyaline; trichomes 15 mic. in diameter; cells shorter than the diameter; cell contents olive; heterocysts oblong, solitary.

Mexico. Gulf of Mexico. (Hooper). West Indies. Guadeloupe. (Mazé). In tufts at joints of *Cymopolia barbata*. Port Maria, Jamaica. March 1893. (Humphrey). On *Dictyota dichotoma*. (Pease and Butler). On *Digenia simplex*. Santurce, Porto Rico. May 1903. (Howe).

513. *Dichothrix utahensis* Tilden. *American Algae. Cent.* III. no. 288. 1898.

Setchell. *Notes on Cyanophyceae.—III. Erythraea.* 7: 45. 1899.

Plant mass impregnated with calcium carbonate, light blue-green, .5-1 cm. in thickness; filaments 22-30 mic. in diameter, generally thickened at the base; false branches appressed, included below in the common tegument; sheaths thick, lamellose, colorless or brownish; trichomes 7.5-12.5 mic. in diameter, sometimes constricted at joints, tapering into a long hair; cells in lower portions equal to the diameter in length, in upper parts shorter than the diameter; cell contents olive green; heterocysts basal and intercalary, the former one to three in number.

Utah. Forming a calcareous crust on an old board and on stones in a small stream running from a brackish pond into Great Salt Lake, one mile northeast from Black Rock, Garfield Beach. July 1897. (Tilden).

The above species resembles *D. gypsophila* and *D. calcarea* in its habit of forming a calcareous crust and in some minor characters; like *Calothrix scopularum* it has the basal portion of the filament thickened and often shows two or three basal heterocysts. Dr. Setchell refers it to *Calothrix parietina*, but the filaments are much too large for that species, there are numerous intercalary heterocysts, and it differs in several other important characteristics.

Genus **POLYTHRIX** Zanardini. *Phyc. Indic. Pugillus.* 32. 1872.

Plant mass filiform, branched, consisting of numerous filaments fasciculately arranged, included within a common tegument; filaments densely crowded, branched; heterocysts terminal and intercalary.

514. *Polythrix corymbosa* (Harvey) Grunow in herb. Bornet and Flahault. *Revis. des Nostoc. Ann. Sci. Nat. Bot.* VII. 3: 380. 1886. Harvey. *Nereis Boreali-Americana. Part. III.* 109. pl. 28 B. 1858. (*Micrococleus corymbosus* Harv.). De Toni. *Syll. Algar.* 5: 645. 1907.

Farlow. List Marine Algae U. S. Proc. Am. Acad. Arts Sci. 10: 380. 1875. Murray. Catalogue of the Marine Algae of the West Indian Region. Journ. of Bot. 27: 261. 1889. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 21. no. 1016. 1903.

Plant mass caespitose, pulvinate, expanded, made up of rigid, fastigiate, twisted tufts 1-3 cm. in height, dichotomously or irregularly branched; common tegument transparent or yellowish; trichomes 5-6 mic. in diameter, tapering into a thin hair at the apex; heterocysts somewhat spherical.

Florida. On mud flats near high water mark. Key West. (Harvey, Farlow). Forming a turf, 1 cm. thick, on rocks just below low water mark. Key West. October 1902. (Howe).

Genus **SACCONEMA** Borzi.

Morfologia, etc. N. Giorn. Bot. Ital. 14: 282, 298. 1882.

Plant mass or colony small, gelatinous, lobed or torn; common tegument lamellose, very much folded and saccate, finally dissolved at apices, containing from two to many trichomes; trichomes irregularly aggregated, somewhat caespitose; false branches short, moniliform, not coalesced; heterocysts basal, spherical; gonidia present.

515. *Sacconema rupestre* Borzi. Note alla Morfologia e Biologia delle Alghe Ficocromacee. Nuovo Giorn. Bot. Ital. 14: 282, 298. pl. 16, 17. f. 9-12. 1882. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 3: 381. 1886. De Toni. Syll. Algar. 5: 646. 1907.

Hauck and Richter. Phyk. Univ. no. 741. 1891. Wittrock, Nordstedt and Lagerheim. Algae Aq. Dulc. Exsicc. no. 1309. 1896.

Plate XIX. fig. 4.

Trichomes 8 mic. in diameter; heterocysts basal, spherical; gonidia 15 mic. in diameter; wall of gonidium roughened.

Massachusetts. Suntaug Lake, Tynnfield. September 1890. (Collins).

Genus **ISACTIS** Thuret. Essai Class. Nostochinées. II. 1885.

Plant mass flat, crustaceous, orbicular, thin, adhering by the lower surface, growing at the margin; filaments parallel, erect, unbranched or rarely sparingly branched; heterocysts basal; gonidia unknown.

I Filaments decumbent at base; trichomes 7-9 mic. in diameter

I. *plana*

II Filaments slightly swollen at base; trichomes 8-10 mic. in diameter

I. *centrifuga*

516. *Isactis plana* (Harvey) Thuret. Essai Class. Nostochinées. II. 1885. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 344. 1886. De Toni. Syll. Algar. 5: 646. 1907.

Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Mastigonema plana* Rab.). Farlow. Marine Algae of New Eng-

land. 39. pl. 1. f. 2. 1881. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 106. 1886. **Collins.** Marine Algae of Nantucket. 5. 1888; Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310. 1888. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 4. no. 156. 1896. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 42. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 224. 1905.

Plate XIX. fig. 5.

Plant mass green, becoming brown or black, showing dark purple tints when dried; filaments decumbent at the base, up to .5 mm. in length, crowded; sheaths close, transparent, sometimes yellowish, scarcely distinct; trichomes 7-9 mic. in diameter, produced at the apex into a very long, thin hair; cells shorter than their diameter; cell contents blue-green or greenish violet.

New England. Very common on rocks and on other algae, forming dark green spots scarcely raised above the substance on which it is growing. (Farlow). **Massachusetts.** On *Fucus vesiculosus* at half tide. Cuttyhunk. August 1894. (Setchell). On shells. Polpis. (Collins). **Connecticut.** On stones. Charles Island. September. (Holden). **New York.** Wet rocks. Portage. (Wolle). On shells at and below low water mark. Cold Spring Harbor. August 1895. (Johnson). Shores of Long Island. On *Fucus*. Fort Hamilton, Jamaica Bay. (Pike). **New Jersey.** On stones and old oyster shells. Atlantic City. (Morse, Martindale).

Var. *fissurata* Bornet and Flahault. l. c. 345. De Toni. l. c. 647.

Setchell and Gardner. Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 198. 1903.

Plant mass zonate; filaments branched, closely cohering; especially rock-loving.

Alaska. On stones. Captains Bay, Unalaska. (Lawson).

517. *Isactis centrifuga* Bornet in Collins. Notes on Algae.—III. Rhodora. 3: 136. 1901. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 16. no. 757. 1900. De Toni. Syll. Algar. 5: 647. 1907.

Plant mass up to 4 cm. in diameter, the growth marginal, the central portion of the mass becoming detached from the substratum and rounding upwards, while the margin remains closely attached, dark green or nearly black; filaments 8-12 mic. in diameter, slightly swollen at base, reaching a length of a millimeter; sheaths firm, usually translucent, sometimes brownish and opaque; trichomes 8-10 mic. in diameter; cells one-third to one-half as long as wide; heterocysts basal, spherical or depressed, rarely intercalary and spherical or elongate.

Rhode Island. On soft crumbling rocks, at low water mark. Ochre Point, Newport. May, June 1900. (Collins).

Genus *RIVULARIA* (Roth) Agardh. Syst. Algar. 19. 1824.

Colonies spherical, hemispherical or inflated and lobed, solid or hollow, sometimes confluent into an indefinite mass; filaments radiating from the center, repeatedly branched; sheaths conspicuous near the base of the trichomes, near the periphery of the colony gelatinous and confluent; heterocysts basal; gonidia more or less cylindrical and elongate, not known in all species.

- I Filaments flagelliform, tapering towards the apex; gonidia present
 - 1 Colonies hard; trichomes 4-7 mic. in diameter; gonidia 9-15 mic. in diameter, especially cylindrical *R. pisum*
 - 2 Colonies soft; trichomes 7-9 mic. in diameter; gonidia 10-18 mic. in diameter, larger at the base *R. natans*
 - 3 Colonies firm, solid, light green; gonidia cylindrical, frequently curved, about nine times as long as broad *R. incrustata*
 - 4 Colonies soft, solid; trichomes 8-10 mic. broad at the base; gonidia 8-18 mic. in diameter, cylindrical, straight or slightly curved *R. echinulata*
- II Filaments gradually tapering; gonidia unknown
 - 1 Colonies hollow when old
 - (1) Colonies soft; trichomes 4-5 mic. in diameter in lower portion, somewhat constricted at joints *R. polyotis*
 - (2) Colonies soft; trichomes 2-5 mic. in diameter, cylindrical *R. nitida*
 - 2 Colonies solid
 - (1) Colonies not encrusted with calcium carbonate
 - A Plants living in fresh water
 - a Trichomes 4 mic. in diameter *R. borealis*
 - b Trichomes 6-10 mic. in diameter *R. compacta*
 - c Trichomes 9-12.5 mic. in diameter *R. minutula*
 - d Trichomes continuous or indistinctly divided; heterocysts 10-12 mic. in diameter *R. paradoxa*
 - B Plants living in salt water; trichomes 2.5-5 mic. in diameter *R. atra*
 - (2) Colonies encrusted with calcium carbonate
 - A Colonies hemispherical, finally confluent and forming a hard, stony crust; trichomes 4-7.5 mic. in diameter *R. haematites*
 - B Colonies small, somewhat hard; trichomes 4-9 mic. in diameter *R. dura*
 - C Colonies at first hemispherical, afterwards forming a gelatinous crust, indurated with calcium carbonate in the interior; trichomes 5-9 mic. in diameter *R. coadunata*
 - D Colonies spherical, hard; trichomes 4-16 mic. in diameter *R. bornetiana*

Species not well understood

*R. mexicana**R. microscopica**Z. minutula**Z. mollis*

518. *Rivularia pisum* Agardh. Syst. Algar. 25. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 366. 1886. (*Gloeotrichia pisum* Thur.). De Toni. Syll. Algar. 5: 653. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 47. pl. 2. f. 9. 1872. (*R. cartilaginea* Wood). Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. Campbell. Plants of the Detroit River. Bull. Torr. Bot. Club. 13: 93. 1886. (*R. echinata* Eng. Bot.). Arthur. Some Algae of Minnesota supposed to be Poisonous. Fourth Bien. Report Bd. Regents. Suppl. 1. 99. 1887; Second Report on some Algae supposed to be Poisonous. 1. c. 109. 1887. (*G. pisum* (Ag.) Thur.). Collins. Algae of Middlesex County. 13. 1888. Wolle and Martindale. Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. Anderson and Kelsey. Common and Conspicuous Algae of Montana. Bull. Torr. Bot. Club. 18: 143. 1891. Saunders. Protophyta-Phycophyta. Flora of Nebraska. 25. pl. 3. f. 33. 1894. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 311. 1897. Tilden. List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 27. 1898. Kellerman. Proposed Algological Survey of Ohio. Ohio Nat. 2: 222. 1902. Nelson. Observations upon some Algae which cause "Water Bloom." Minn. Bot. Studies. 3: 52, 56. 1903. Collins. Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 238. 1905. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 27. no. 1310. 1905.

Plate XIX. fig. 6.

Colonies small, 1-2 mm., rarely up to 1 cm. in diameter, spherical, hard, blackish green; filaments crowded; trichomes 4-7 mic. in diameter, ending in a hair; cells somewhat quadrate; cell contents olive; gonidia 9-15 mic. in diameter, 60-400 mic. in length, surrounded by a special sheath.

Massachusetts. Medford, Newton. (Farlow). On stems of flowering plants. Lake Quannapowitt, Wakefield. September 1906. (Collins). Connecticut. Floating on the surface, forming a verdigris-green scum. Twin Lakes, Salisbury. October 1892. (Setchell and Holden). New Jersey. "Parasitic" on aquatic plants in ponds and pools. (Wolle). Ohio. (Kellerman). Michigan. Attached to leaves of water plants in marsh. Northern part of state. (Wood). Grosse Isle, near mouth of Detroit River. Summer of 1885. (Campbell). Minnesota. Lake Phalen, near St. Paul. August 1882; Lake Tetonka, at Waterville. July 1883; Lake Minnetonka. August 1883. (Farlow and Arthur). Abundant on water plants. Vermilion Lake. July 1886. (Arthur, Bailey and Holway). Floating on surface of water in large quantity. Lake Minnewaska, Glenwood. August 1897. (Foss). Iowa. On *Utricularia*. East Okoboji Lake. July 1883. (Farlow and Arthur).

Nebraska. On water plants. Minden. (Saunders). **Montana.** On leaflets of *Myriophyllum*. Common in Sand Coulee Creek. (Anderson and Kelsey).

519. *Rivularia natans* (Hedwig) Welwitsch. Synopsis Nostochinearum Austriae Inferioris. 17. 1836. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 369. 1886. De Toni. Syll. Algar. 5: 648. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 47. 1872. (*Gloeotrichia angulosa* Rab.). **Wolle.** Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877; Fresh-Water Algae U. S. 246. pl. 178. f. 4-20; pl. 179. f. 10, 11. 1887. **Rabenhorst.** Algen Europa's. no. 2539. (*Gloeotrichia parvula* Rabenh.). **Bennett.** Plants of Rhode Island. 114. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 24. pl. 3. f. 32. 1894. **Tilden.** American Algae. Cent. I. no. 80. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 5. no. 214. 1896. **Collins.** The Algae of Jamaica. Proc. Am. Acad. 37: 242. 1901. **Tilden.** American Algae. Cent. VI. no. 569. 1902. **Kellerman.** Proposed Algalogical Survey of Ohio. Ohio Nat. 2: 222. 1902. **Clark.** The Holophytic Plankton of Lakes Atitlan and Amatitlan. Guatemala. Proc. Biol. Soc. Wash. 21: 98. 1908.

Plate XIX. fig. 7, Plate XX. fig. 1-3.

Colonies up to 10 cm. in diameter, spherical, bullate, hollow, soft, dull olive green; filaments loosely associated; trichomes 7-9 mic. in diameter, tapering into a thick hair; lower cells barrel-shaped, about as long as wide, upper cells shorter than the diameter; cell contents olive; heterocysts 6-12 mic. in diameter, usually spherical; gonidia without sheath 10-18 mic. in diameter, 40-250 mic. in length; external sheaths up to 40 mic. in diameter, often wide, folded and wrinkled, transparent or brownish, with smooth surface.

Rhode Island. (Bailey). **New York.** Attached to water plants, in pools. Buffalo. (Wolle). When young attached to stones and weeds, afterwards floating free. Shore of Cayuga Lake, Ithaca. September 1895. (Atkinson). **New Jersey.** In small ponds and pools. (Wolle). **Pennsylvania.** On water plants. Bethlehem. July 1877. (Wolle). **Ohio.** (Kellerman). **Minnesota.** Floating near edge of artificial lake Minneapolis. August 1894; on pondweeds in pond. Woodland Park, Duluth. August 1901. (Tilden). **Nebraska.** Minden. (Saunders). **Central America.** Among sponges. (Meek). **West Indies.** Under *Nymphaea* leaves. Botanic Garden, Castleton, Jamaica. April 1893. (Humphrey). **Hawaii.** Forming soft brown velvety masses, appearing spherical in the water, collapsing when taken out. In lower terrace water of rice field, with *Chara*. Aiea, Oahu. June 1900. (Tilden).

520. *Rivularia incrustata* (Wood) De Toni. Syll. Algar. 5: 656. 1907. **Wood.** Contr. Hist. Fresh-Water Algae North America. 45. pl. 3. f. 4. 1872. (*Gloeotrichia incrustata* Wood).

Tilden. American Algae. Cent. I. no. 81. 1894; List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1896.

Colonies spherical or somewhat oval, firm, solid, about the size of a very small pea, crystal-bearing, light green; filaments straight or slightly curved, produced into long hairs, not regularly articulated; apex of filament straight or slightly curved, mostly indistinctly articulate, frequently interrupted; sheaths ample, transparent, saccate, sometimes strongly constricted; lower cells in the mature filament short and generally compressed; gonidia cylindrical, frequently curved, about nine times as long as broad.

Pennsylvania. Growing attached to small water plants. Schuylkill River, near Spring Mills, Philadelphia. (Wood). **Minnesota.** Attached to Chara. Lake Minnetonka, Hennepin County. August 1894. (MacDougal).

521. *Rivularia echinulata* (Smith) Bornet and Flahault. Sur la Determination des Rivulaires qui forment des Fleurs d'Eau. Bull. Soc. Bot. de France. 31: 76. 1884. De Toni. Syll. Algar. 5: 657. 1907.

Farlow. Notes on Fresh-Water Algae. Bot. Gaz. 8: 224. 1883. (*R. fluitans* Cohn); 8: 246. 1883. (*Echinella articulata* Ag.). Witrock and Nordstedt. Algae. Aq. Dulc. Exsicc. no. 664. 1884. Wolle. Fresh-Water Algae U. S. 249. pl. 179. f. 4. 1887. Richter. Bot. Gaz. 19: 425. 1894. Tilden. List of Fresh-Water Algae collected in Minnesota during 1894. Minn. Bot. Studies. 1: 236. 1895. Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 7. no. 311. 1897. (*G. pisum* (Ag.) Thur.). Howe. A Note on the "Flowering" of the Lakes in the Adirondacks. Torreyana. 3: 150. 1903.

Plate XX. fig. 4.

Colonies solid, free swimming, soft, firm when dried, .5-1.5 mm. in diameter, especially spherical, sometimes lenticular, straight or recurved, cylindrical, with the surface villous from the protruding trichomes; filaments radiately arranged, loosely associated; trichomes 8-10 mic. broad at the base, ending in a long hair; lower cells spherical, those in the middle of the trichome quadrate, upper cells long cylindrical, the end cell pointed; cell contents showing sulphur granules or vacuoles; heterocysts 9-10 mic. in diameter, oblong or spherical; gonidia 8-18 mic. in diameter, 44-50 mic. in length, cylindrical, straight or slightly curved, with granular contents.

New York. Honnedaga Lake, Herkimer County. Altitude 2,200 feet. August; Chilson Lake, Essex County, June to August. (Smith). **Minnesota.** Lake Sakatah and Lake Tetonka, Waterville. (Porter). Lake Minnetonka. August 1883; Waterville, June 1884. (Arthur). Lake Minnetonka. August 1883. (Farlow). Lake Chisago, Chisago County. July 1894. (MacDougal and Anderson).

Note: See also the two articles by Professor Arthur under *R. pisum*.

522. *Rivularia polyotis* (Agardh) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 360. 1886. De Toni. Syll. Algar. 5: 659. 1907.

Collins. Algae from Atlantic City, N. J. Bull. Torr. Bot. Club. 15: 310.

1888. (*R. hospita* Thur.). **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 21. no. 1015. 1903.

Plate XX. fig. 5, 6.

Colonies up to 3 cm. in diameter, at first hemispherical, pulvinate, gregarious, finally becoming bullate, hollow, soft, dull blackish green; sheaths wide, lamellose, ocreate, funnel-shaped, dilated, the outer layers confluent into an amorphous gelatin, becoming yellowish brown with age; trichomes 4-5 mic. in diameter in lower portion, above 8-13.5 mic. in diameter, somewhat constricted at joints, tapering into a thick hair; lower cells about twice as long as their diameter, upper cells twice as short as the diameter.

New Jersey. On roots of *Spartina* and on oyster shells. (Morse). **Florida.** On pneumatophores of the black mangrove (*Avicennia nitida*), just above low water mark. Key West. October 1902. (Howe).

523. **Rivularia nitida.** Agardh. Dispositio Algarum Sueciae. 44. 1817. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 357. 1887. De Toni. Syll. Algar. 5: 661. 1907.

Farlow. Marine Algae of New England. 38. 1881. (*Rivularia plicata* Carm.). **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 106. 1886. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Collins.** Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 247. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 6. no. 260. 1897. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900. **Tilden.** American Algae. Cent. VI. no. 571. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 198. 1903. **Collins.** Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 224. 1905.

Colonies up to 3 cm. in diameter, spherical or expanded, plicate-corrugate, soft, hollow, olive green; filaments crowded; sheaths close, narrow, scarcely distinct, in the lower portion of the filament expanded, transparent or yellowish brown; trichomes 2-5 mic. in diameter, cylindrical, ending in a very thin, very long hair; lower cells three or four times longer than their diameter, upper cells shorter; cell contents olive.

Alaska. On mud near high water mark. St. Michael. (Setchell). **Canada.** In stream attached to roots of higher plants. Minnesota Seaside Station, Port Renfrew, Vancouver Island, British Columbia. July 1901. (Leavitt and Crosby). **Nova Scotia.** (Collins). **Maine.** On woodwork, rare. (Collins). **New Hampshire.** (Collins). **Massachusetts.** On mud and *Spartina* roots. Cohasset Narrows; Wood's Holl. (Farlow). On woodwork. Wellington, Medford. October 1892. (Collins). On roots of *Spartina*. Quamquisset Harbor, Falmouth. July and August 1891. (Setchell). **Rhode Island.** (Collins). **Connecticut.** On bank of outlet. Fresh Pond. July to September. (Holden). **New York.** Prince's Bay, Staten Island; shores of Long Island, Jamaica Bay, Canarsie. (Pike).

524. *Rivularia borealis* P. Richter. Süsswasseralgen aus dem Umanak-distrikt. Bib. Bot. 7: Heft. 42. 4. f. 1. 1897. De Toni. Syll. Algar. 5: 664. 1907.

Plate XX. fig. 7, 8.

Colonies up to .5 mm. in diameter, small, spherical or hemispherical, gregarious, sometimes confluent into an indefinite mass, soft, not indurated with calcium carbonate; filaments up to 200 mic. in length, loosely associated; sheaths in the interior of the mass close, those near the periphery expanded, narrow at the apex, diffuent with age; trichomes 4 mic. in diameter, ending in a hair; lower cells depressed, shorter than the diameter, upper cells quadrate; heterocysts 4 mic. in diameter, spherical.

Greenland. On submerged plants and especially on *Myriophyllum ephiphytica*, in a lake. Umanak. (Vanhöffen).

525. *Rivularia compacta* Collins in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 11. no. 508. 1898; Notes on Algae.—I. Rhodora. 1: 10. 1899.

Colonies spherical or somewhat spherical, firm, not encrusted with lime, smooth, minute, seldom over 2 mm. in diameter, dark green or blackish; filaments 15-20 mic. in diameter, closely packed; sheaths more or less expanded above, colorless or yellowish; trichomes 6-10 mic. in diameter, constricted at joints, tapering gradually to a hair-like termination; cells about as long as broad below, one-third to one-quarter as long above; heterocysts basal, spherical or oblong.

Massachusetts. On stones, shore of Spot Pond, Middlesex Fells. September 1890. (Collins). **Connecticut.** Norwich. (Setchell).

This species "resembles *R. minutula* (Kuetz.) Born. & Flah., but the thalli are much firmer, and not at all encrusted with lime; the trichomes are slenderer, and the filaments more densely packed. In some particulars it agrees with the description of *R. beccariana* (De Not.) Born. & Flah., Revis. des Nost., part 2, p. 56; but the latter has more slender trichomes, with longer articulations and much narrower sheaths."—Collins.

526. *Rivularia minutula* (Kuetzing) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 348. 1886. De Toni. Syll. Algar. 5: 672. 1907.

Wolle. Fresh-Water Algae. V. Bull. Torr. Bot. Club. 8: 38. 1881. (*R. radians minutula* Kirchn.). **Stalker.** Report on the Waterville Cattle Disease. Fourth Bien. Rep. Bd. Regents Univ. of Minn. Suppl. I. Rep. Dept. Agric. Univ. of Minn. 105, 108. 1887. (*Limnactis minutula* Kuetz.). **Collins.** Algae of Middlesex County. 13. 1888. (*R. radians* Thur.). **Richter** in Kuntze. Revisio Generum Plantarum. Part III. II. 389. 1898.

Plate XX. fig. 9.

Colonies up to 8 mm. in diameter, spherical or hemispherical, sometimes confluent, soft or indurated with calcium carbonate, blue-green or brownish; filaments loosely associated; sheaths 27 mic. in thickness, wide,

lamellose, ocreate, hyaline or brownish; ocreae funnel-shaped, dilated above; trichomes 9-12.5 mic. in diameter, gradually tapering into a thick hair with short cells; lower cells somewhat quadrate, upper cells three or four times shorter than their diameter; heterocysts oblong or hemispherical.

Massachusetts. Spot Pond, Stoneham. (Collins). **Minnesota.** "Very abundant, covering the surface of the lake for a considerable extent. The natives consider it to be grass seed washed into the lake." July 1880. (Hobbe). **Iowa.** In West Okoboji Lake, Dickinson County. (Stalker). **Montana.** On water plants. 1874. (Kuntze).

527. *Rivularia paradoxa* (Wolle) De Toni. Syll. Algar. 5: 672. 1907. Wolle. Fresh Water Algae. II. Bull. Torr. Bot. Club. 6: 138. 1877. (*Zonotrichia paradoxa* Wolle); Fresh Water Algae. III. l. c. 184.

Colonies hemispherical, gelatinous, bright blue-green; younger filaments flagelliform, older ones often contracted in the middle, or narrow below and gradually widened more than half the length, then tapering to a fine point (filaments of the latter form are usually much longer, double the length of the former); trichomes continuous or indistinctly divided; cells quadrate to three times as long as wide, very variable; cell contents granular, green tinged with brown; heterocysts 10-12 mic. in diameter.

Pennsylvania. Wolle.

528. *Rivularia atra* Roth. Catalecta Botanica. 3: 340. 1806. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 353. 1886. De Toni. Syll. Algar. 5: 664. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 50. 1872. (*Zonotrichia minutula* Rab.). **Farlow.** List Marine Algae United States. Proc. Am. Acad. Arts Sci. 10: 380. 1875. **Farlow.** Marine Algae of New England. 38. pl. 2. f. 2. 1881. **Kjellman.** Algae of the Arctic Sea. 321. 1883. (*Rivularia hemispherica* (L.) Aresch.). **Farlow.** Notes on Fresh-Water Algae. Bot. Gaz. 8: 224. 1883. **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 106. 1886. **Collins.** Marine Algae of Nantucket. 5. 1888. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Anderson.** List of California Marine Algae, with Notes Zoe. 2: 218. 1891. **Collins.** Algae.—Rand and Redfield's Flora of Mount Desert Island, Maine. 247. 1894. **Rosenvinge.** Les Algues Marines du Groenland. Ann. Sci. Nat. Bot. VII. 19: 162. 1894. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 8. no. 357. 1897. **Rosenvinge.** Deuxième Mémoire sur les Algues Marines du Groenland. Medd. om Groenland. 20: 121. 1898. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900; Phycological Notes of the late Isaac Holden.—II. Rhodora. 7: 224. 1905. **Börgesen and Jonsson.** The Distribution of the Marine Algae of the Arctic Sea and of the Northernmost Part of the Atlantic. Bot. Faeroes. App. XXV. 1905.

Plate XX. fig. 10.

Colonies up to 4 mm. in diameter, spherical, solitary or confluent, dark

green; filaments crowded; sheaths close, narrow, scarcely distinct, above widened, hyaline or yellowish; trichomes 2.5-5 mic. in diameter, ending in a thin hair; lower cells scarcely longer than the diameter, upper cells shorter; cell contents blue-green.

Greenland. In upper part of littoral zone on sheltered coasts, gregarious, but in small numbers. West coast; Baffin Bay, at Tessarmiut, Ameralik, Pikitsok. (Kjellman). Western part. (Börgesen and Jonsson). Eastern part, south of 70° lat. N. (Rosenvinge). **Canada.** On rocks and other algae. Malpeque, Prince Edward Island. (Faull). **New England.** Common along the whole coast, on stones, algae and stalks of *Spartina*. (Farlow). **Maine.** Common in upper tide pools. (Collins). Sea Wall. (Holden). **New Hampshire.** (Collins). **Massachusetts.** On shells in harbor; on sides of rock pools, Marblehead, August 1897. (Collins). **Rhode Island.** (Collins). **Connecticut.** On turf of *Spartina*. Charles Island. September. (Holden). **New York.** Shores of Long Island. Hell Gate, Flushing Bay. (Pike). **New Jersey.** Marine. On stones. Atlantic City. (Martindale). **California.** Common. On stones, algae and other material. (Anderson).

Var. *confluens* (Kuetzing) Bornet. Les Algues de Schousboe. 29. 1892. De Toni. l. c. 666.

Colonies confluent forming a layer or mass.

Maine. On ground between tide marks. Cape Rosier. July 1897. **Connecticut.** On turf of *Spartina* roots. Charles Island, near Milford. September 1896. (Holden).

529. *Rivularia haematites* (DC.) Agardh. Syst. Algar. 26. 1824. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 350. 1886. De Toni. Syll. Algar. 5: 668. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 49. 1872. (*Zonotrichia parcezonata* Wood). **Wolle.** Fresh Water Algae. III. Bull. Torr. Bot. Club. 6: 184. 1877. (*Zonotrichia haematites* Rabenh.). **Dickie.** On the Algae found during the Arctic Expedition. Journ. Linn. Soc. Bot. 17: 8. 1880. (*Zonotrichia fluviatilis* Kuetz.). **Campbell.** Plants of the Detroit River. Bull. Torr. Bot. Club. 13: 93. 1886. (*Rivularia calcarea* Eng. Bot.). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 603. 1889. (*Isactis fluviatilis* (Rab.) Kirchn.). **Saunders.** Protophyta-Phycophyta. Flora of Nebraska. 25. pl. 3. f. 31. 1894. **Setchell.** Notes on Cyanophyceae.—I. Erythea. 4: 88. 1896. **Tilden.** American Algae. Cent. III. no. 289. 1898; Observations on some West American Thermal Algae. Bot. Gaz. 25: 96. pl. 9. f. 6-9. 1898.

Plate XX. fig. 11-14.

Colonies hemispherical, finally confluent and forming a hard, stony crust, up to a centimeter in thickness, green or olive in color, blue-green when dried, zoned in the interior; filaments dense; sheaths close, hyaline or rarely yellowish, fragile, strongly refringent, above ocreate, funnel-shaped, dilated; trichomes 4-7.5 mic. in diameter, ending in a very long

hair; lower cells twice as long as the diameter, those in the middle of the trichome quadrate, the upper ones half as long as wide.

Arctic Regions. "Forming firm, gelatinous bosses on pebbles in running water." In streams from a lake, winter-quarters. $82^{\circ} 27' N.$, $61^{\circ} 22' W.$ (Moss). **Canada.** Forming a calcareous crust on bottom of ditch. Natural Sulphur Springs, Banff, Alberta. 13 August 1897. (Tilden). **New York.** Forming a slippery grayish, or grayish flesh-colored coating on rocks kept wet and glistening with foam and spray. "Cave of the Winds," Niagara Falls. (Wood). "Growing on rocks as glossy blackish, very hard and slippery fronds or masses, which varied in size from that of very small shot to nearly half an inch in length." (Wood). **New Jersey.** Rocky margins of Green Pond, Morris. (Wolle). **Pennsylvania.** Stones. Susquehanna River. (Wolle). **Michigan.** Grosse Isle, near the mouth of the Detroit River. Summer of 1885. (Campbell). **Nebraska.** Minden. (Saunders). **Colorado.** Forming a reddish crust upon dripping rocks. Bridal Veil Falls, Williams Cañon, near Manitou. (Setchell).

530. *Rivularia dura* Roth. Neue Beiträge zur Botanik. 273. 1802. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 347. 1886. De Toni. Syll. Algar. 5: 674. 1907.

Wood. Contr. Hist. Fresh-Water Algae North America. 50. pl. 4. f. 5. 1872. (*Dasyactis mollis* Wood). **Campbell.** Plants of the Detroit River. Bull. Torr. Bot. Club. 13: 93. 1886. **Wolle.** Fresh-Water Algae U. S. 249. pl. 179. f. 1-3. 1887. **Bennett.** Plants of Rhode Island. 114. 1888. **Collins.** Algae of Middlesex County. 13. 1888. (*R. radians* Thur.). **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **Mackenzie.** A Preliminary List of Algae collected in the Neighborhood of Toronto. Proc. Can. Inst. III. 7: 270. 1890. **Snow.** The Plankton Algae of Lake Erie. U. S. Fish Comm. Bull. for 1902. 22: 392. 1903.

Plate XX. fig. 15.

Colonies small, 5 mm. in diameter, somewhat hard, indurated with calcium carbonate, blackish green; filaments dense; sheaths close, not lamellose, uniform, hyaline; trichomes 4-9 mic. in diameter, ending in a long, very thin hair; lower cells equal in length to the diameter, upper ones almost three times shorter than wide; cell contents blue-green, sometimes changing to violet when dried.

Canada. High Park, Toronto. (Mackenzie). **Massachusetts.** (Collins). **Rhode Island.** Not uncommon. (Bennett). **New Jersey.** Attached to aquatic plants in ponds. (Wolle). **Ohio.** Plankton. Lake Erie. Put-in-Bay. (Snow). **Michigan.** Attached to water plants in a small bog near mouth of Carp River in northern part of state. (Wood). Grosse Isle, near the mouth of the Detroit River. Summer of 1885. (Campbell).

531. *Rivularia coadunata* (Sommerfelt) Foslie. Contributions to Knowledge of the Marine Algae of Norway. II. Tromsø Mus. Aarsheft. 14: 21. 1891. Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat.

Bot. VII. 4: 352. 1886. (*R. biaolettiana* Menegh.). De Toni. Syll. Algar. 5: 667. 1907.

Collins. Notes on New England Algae. Bull. Torr. Bot. Club. 9: 69. 1882. (*Rivularia warreniae* Thur.). **Setchell.** Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 427. 1895. **Tilden.** American Algae. Cent. II. no. 166. 1896. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 8. no. 358. 1897. **Tilden.** List of Fresh-Water Algae collected in Minnesota during 1896 and 1897. Minn. Bot. Studies. 2: 27. 1898. **Collins.** Preliminary Lists of New England Plants. —V. Marine Algae. Rhodora. 2: 43. 1900. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 18. no. 860. 1901. **Saunders.** The Algae. Harriman Alaska Expedition. Proc. Wash. Acad. Sci. 3: 399. 1901. **Tilden.** American Algae. Cent. VI. no. 570. 1902. **Setchell and Gardner.** Algae of Northwestern America. Univ. Calif. Pub. Bot. 1: 198. 1903.

Plate XX. fig. 16, 17.

Colonies at first hemispherical, afterwards expanded into an olive or blackish, gelatinous, crustaceous, cushion-like layer, 2-8 mm. in thickness, indurated with calcium carbonate in the interior; filaments about 18 mic. in diameter, approximate; sheaths wide, lamellöse, colorless or yellowish, or showing transverse zones, ocreate; ocreae dilated, funnel-shaped; trichomes 5-9 mic. in diameter, ending in a very thin, long, flexuous hair; lower cells a little shorter than the diameter, the upper ones one-third as long as broad; cell contents blue-green; heterocysts oblong, basal, one to three, rarely intercalary.

Alaska. On dripping rocks, on roots, etc., in fresh or brackish water. West shore of Amaknak Island, Bay of Unalaska; at mouth of creek, Iliuliuk, Unalaska. (Setchell and Lawson). Forming minute, hard, dark bluish green thalli, 1-3 mm. in diameter, which finally become agglutinated into hollow, indefinite masses. On rocks in freshwater streams. Juneau; Glacier Bay. (Saunders). **Canada.** On sandstone rocks just above high tide, but submerged or at least washed by waves during storms. Minnesota Seaside Station, Port Renfrew, Vancouver Island, British Columbia. December 1901 (Tilden). **New Hampshire.** (Collins). **Massachusetts.** Growing on a rock, above high water mark but where the spray formed little pools in rough weather. Marblehead. September 1881; in moist places just above high water mark. Marblehead. June 1901. (Collins). **Rhode Island.** (Collins). **Connecticut.** Occurring in fairly typical form in perfectly fresh water. Gardner's Lake. Eastern part of the state. (Setchell). **South Dakota.** On rocks at edge of lake. Big Stone Lake. October 1895. (Griffiths). **Washington.** East Sound, Orcas Island. (Gardner). **California.** On dripping vertical faces of the cliff, just above high water mark. Carmel Bay, Monterey County. December 1896. (Nott and Setchell).

532. *Rivularia bornetiana* Setchell. Notes on some Cyanophyceae of New England. Bull. Torr. Bot. Club. 22: 426. 1895. De Toni. Syll. Algar. 5: 666. 1907.

Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 4. no. 157. 1896.

Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 43. 1900.

Colonies 1 mm. to more than a centimeter in diameter, solid, spherical, sometimes coalescing into a cylindrical mass 5-8 cm. long, rather firm, deep bluish black when young, later becoming light olive green or pale yellow, not incrustated with lime; filaments 8-20 mic. in diameter, radiating from the center, flexuous in older colonies; sheaths wide, conspicuous, colorless to deep brown in color, very much lamellose and ocreate above; trichomes usually 4 mic. in diameter, occasionally reaching 16 mic., very torulose when young, very little so when older; terminal hairs long and slender in younger plants, almost wanting in the older ones; cells from one-half to five times as long as broad; transverse walls distinct in younger trichomes, very obscure in older specimens; cell contents provided with a few scattered granules, light blue; heterocysts 6-8 mic. in diameter, basal, depressed spherical or ellipsoidal in shape.

Nova Scotia. (Holden, Setchell). **Rhode Island.** Forming globular thalli on *Ruppia maritima* in brackish water. Watch Hill Pond, Watch Hill. September 1892. (Setchell).

533. *Rivularia mexicana* (Kuetzing) Rabenhorst. Fl. Eur. Algar. 2: 222. 1865. De Toni. Syll. Algar. 5: 676. 1907.

Colonies soft, gelatinous, somewhat spherical or irregular, pale green, at first attached, finally floating free; trichomes 8-10 mic. in diameter, loosely entangled, flagelliform, tapering into a colorless hair at the apex.

Mexico. In stagnant water. (Müller).

534. *Rivularia microscopica* Dickie. Notes on the Algae. Sutherland's Journal of a Voyage in Baffin's Bay and Barrow Straits in the Years 1850-51. 2: 193. 1852. De Toni. Syll. Algar. 5: 677. 1907.

Kjellman. Algae of the Arctic Sea. 322. 1883.

Arctic Regions. Growing on *Enteromorpha compressa*. American Arctic Sea; Assistance Bay and "other localities." (Dickie).

535. *Zonotrichia minutula* Wood. Contr. Hist. Fresh-Water Algae North America. 50. 1872. De Toni. Syll. Algar. 5: 675. 1907.

Colonies very small, somewhat spherical, not distinctly zoned, rather soft, not impregnated with calcium carbonate, blackish green; internal filaments very distinctly fasciculately branched; sheaths thick, ample, often pale orange brown, with their apices mostly colorless, torn and open; trichomes 3-5 mic. in diameter; cells short; heterocysts 6 mic. in diameter, ovate to spherical.

New York. Forming very small, blackish green, subglobose masses, attached to mosses. Clear Pond, Adirondack Mountains. (Wood).

536. *Zonotrichia mollis* Wood. Contr. Hist. Fresh-Water Algae North America. 48. pl. 4. f. 3. 1872. De Toni. Syll. Algar. 5: 675. 1907.

Colonies somewhat hemispherical, gregarious, often confluent into a mammillose stratum, somewhat soft, grey or flesh-colored, slightly

zoned; filaments up to 4.2 mic. in diameter, very long, narrow, flexuous; sheaths close, colorless, firm, not fibrous; trichomes up to 2 mic. in diameter, often interrupted; transverse walls visible; cells equal to up to four times longer than broad; heterocysts single, spherical.

New York. On dripping rocks. Cave of the Winds, Niagara. (Wood).

Genus **BRACHYTRICHIA** Zanardini.

Phyc. Indic. Pugillus. 24. 1872.

Colonies at first solid, finally becoming hollow, made up of Nostoc-like filaments embedded in gelatin; filaments flexuously curved, parallel, above tapering and drawn out into a hair at the apex, very much branched; sheaths distinct in the young filaments, tubular, finally becoming confluent and invisible; heterocysts intercalary, arranged without any order.

537. **Brachytrichia quoyi** (Agardh) Bornet and Flahault. Revis. des Nostoc. Ann. Sci. Nat. Bot. VII. 4: 373. 1886. De Toni. Syll. Algar. 5: 680. 1907.

Farlow. List of the Marine Algae of the United States. 25. 1876. (*Rivularia nitida*?). **Bornet** in Farlow, Anderson and Eaton. Algae Am. Bor. Exsicc. no. 45. 1876. (*Hormactis farlowii* Born.); in Farlow. Marine Algae of New England. 39. pl. 2. f. 1. 1881. (*Hormactis quoyi* (Ag.) Bornet). **Pike.** Check List of Marine Algae. Bull. Torr. Bot. Club. 13: 106. 1886. **Martindale.** Marine Algae of the New Jersey Coast and Adjacent Waters of Staten Island. Mem. Torr. Bot. Club. 1: 91. 1889. **Wolle and Martindale.** Algae. Britton's Catalogue of Plants found in New Jersey. Geol. Surv. N. J. 2: 604. 1889. **Hauck and Richter.** Phyk. Univ. no. 681. 1890. **Schiveley.** *Hormactis quoyii*. Proc. Phil. Acad. 1890: 497. 1891. **Wittrock and Nordstedt.** Algae Aq. Dulc. Exsicc. no. 1197. 1893. **Collins, Holden and Setchell.** Phyc. Bor.-Am. Fasc. 1. no. 8. 1895. **Collins.** Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Plate XX. fig. 18.

Colonies up to 5 cm. in diameter, plicate-expanded and bullate, confluent, blackish green.

Massachusetts. Growing on *Fucus* at half tide. Wood's Holl. (Farlow). Falmouth; Wood's Holl. July 1892. (Collins). Forming bladders on stems of old *Fucus vesiculosus* L. Quamquisset Harbor, Falmouth. August 1890. (Setchell). **New York.** Shores of Long Island. Greenport. July. (Pike). **New Jersey.** Atlantic City. (Morse). **California.** Pacific Ocean. (Grunow).

Families and Genera not well understood.

Genus **ASTEROTHRIX** Kuetzing. Phyc. Gen. 200. 1843.

Filaments very rigid, nude, with cuspidate, obtuse or acute ends, somewhat genuflexuous, branched at right angles; transverse walls usually indistinct; propagation unknown.

538. *Asterothrix creginii* Wolle. Fresh-Water Algae U. S. 322. pl. 209. f. 22-25. 1887. De Toni. Syll. Algar. 5: 683. 1907.

Bennett. Plants of Rhode Island. 115. 1888.

Plate XX. fig. 19, 20.

Filaments 2-4 mic. in diameter, short, pale blue-green; branches given off at right angles, cross-like; trichomes often moniliform; transverse walls usually evident.

Rhode Island. Pocasset. (Bennett). Kansas. Norton. (Cregin).

Genus **GONIOTRICHUM** Kuetzing. Phyc. Gen. 244. 1843.

Colonies erect, filamentous, dichotomously or rarely unilaterally branched; filaments at first unbranched, finally branched, by the repeated division of cells at right angles; branches more or less regularly branched; cells showing a central star-shaped chromatophore, a central pyrenoid, and an eccentric nucleus; cell walls diffuent into a gelatinous mucus which forms a thick, gelatinous envelope surrounding each cell.

I Colonies filamentous, solid, gelatinous, occasionally branched

G. humphreyi

II Filaments single or associated in rose-red bundles (colonies), usually thickened at the base, tapering above

G. elegans

539. *Goniotrichum humphreyi* Collins in Collins, Holden and Setchell. Phyc. Bor.-Am. Fasc. 9. no. 421. 1898; The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 251. 1901. De Toni. Syll. Algar. 5: 688. 1907.

Colonies filamentous, solid, gelatinous, occasionally forking or dividing into several branches, the terminal portion consisting of a single series of cells, the older part containing numerous cells irregularly placed near the surface of the filament; lateral branches abundant, simple, issuing nearly at a right angle, composed of a single series of cells.

West Indies. On woodwork of wreck. St. Ann's Bay. March 1893. (Humphrey).

540. *Goniotrichum elegans* (Chauvin) Zanardini. Notizie intorno alle Cellulari Marine delle Lagune e dei Litorali de Venezia. Atti R. Ist. Ven. I. 6: 69. 1847. De Toni. Syll. Algar. 5: 687. 1907.

Collins. The Algae of Jamaica. Proc. Am. Acad. Arts Sci. 37: 251. 1901.

Filaments 20 mic. in diameter, .3-6 mm. in length, single or associated in rose-red bundles or colonies, usually thickened at the base, above tapering, rarely unbranched, often somewhat dichotomously branched; cells 7-10 mic. in diameter, in one or many series, spherical or elliptical; cell contents violet or reddish changing to green.

Canada. In tufts on *Chondrus crispus*. Malpeque, Prince Edward Island. (Faull). **West Indies.** Among other algae on *Laurencia obtusa*. Near Kingston. (Duerden.).

Genus **ASTEROCYTIS** Gobi. Kurzer Bericht Algol. Excur.
St. Petersburg. Gesellsch. Nat. 10: 93. 1879.

Colonies erect, filamentous, branched; cells ellipsoid, irregularly arranged, reproduction by means of non-motile, naked gonidia; sexual reproduction unknown.

541. *Asterocytis ramosa* (Thwaites) Gobi. Kurzer Bericht über die im Sommer 1878 ausgeführte Algologische Excursion. St. Petersburg. Gesellsch. d. Naturf. 10: 93. 1879. De Toni. Syll. Algar. 5: 690. 1907.

Collins. Notes on New England Marine Algae. V. Bull. Torr. Bot. Club. 18: 336. 1891. (*Goniotrichum ramosum* (Thwaites) Hauck).

Plate XX. fig. 21.

Filaments 12-20 mic. in diameter, 1-10 mm. long, associated in green or lead-colored fascicles; branching somewhat dichotomous or unilateral; cells 5-8 mic. in diameter, 8-20 mic. in length, in a single series, cylindrical-rotund or elongate; cell contents lead-colored or green.

Massachusetts. In small quantity among other algae. Quincy. (Collins).

Genus **GLAUCOCYSTIS** Itzigsohn in Rabenhorst.
De Algen Europas. no. 1935. 1866.

Cells elliptical, oval, rarely elongate-elliptical, associated in spherical or elliptical, microscopical families of from two to eight cells, surrounded by a colorless, thin and soon diffuent common tegument; cell contents at first blue in color, finally displaying a blue-green or green chromatophore; reproduction by division of cells in one direction.

542. *Glaucocystis nostochinearum* Itzigsohn in Rabenhorst. De Algen Europas. no. 1935. 1866. De Toni. Syll. Algar. 5: 693. 1907.

Lagerheim. Ueber einige Algen aus Cuba, Jamaica and Puerto-Rico. Bot. Notiser. 199. 1887.

Plate XX. fig. 22.

Cells 10-18 mic. in diameter, 18-28 mic. in length, solitary or in families of from two to eight cells; families elliptical or somewhat spherical; cell contents light blue-green or green; cell walls thin.

West Indies. Fajardo, Porto Rico. (Sintenis, Moebius).

Genus **PORPHYRIDIDIUM** Naegeli. Gatt. Einzell. Alg. 139. 1849.

Plant mass irregularly expanded, thin, gelatinous, crustaceous; cells numerous, spherical or more or less angular by compression; cell contents reddish purple, with a central pyrenoid and an eccentric nucleus; individual

sheaths at first thin, becoming thick, finally diffuent into a gelatinous mucous; reproduction by cell division in all directions.

543. *Porphyridium cruentum* (Agardh) Naegeli. Gatt. Einzell. Alg. 139. pl. 4. 1849. De Toni. Syll. Algar. 5: 697. 1907.

Buchanan. Notes on the Algae of Iowa. Proc. Iowa Acad. Sci. 14: 9. 1908.

Plate XX. fig. 23.

Plant mass often widely expanded, membranaceous, mucous, of a dark red color, sometimes becoming greenish; cells 6.5-9 mic. in diameter, spherical or angular by mutual pressure; cell contents reddish purple.

Iowa. (Buchanan).

Family II. CRYPTOGLLENACEAE

Plants unicellular, blue-green, floating free in water; vegetative cells elliptical, oval or almost wedge-shaped, bearing two cilia of equal length, not motile; cell walls thin, close, colorless; chromatophores disc-shaped, adhering to the wall, enclosing somewhat spherical pyrenoids.

Genus **CRYPTOGLENA** Ehrenberg.

Abhandl. Akad. Wiss. zu Berlin. 150. 1832.

Cells marked by a conspicuous red pigment spot; cell wall often separated from the protoplasm, forming a sac.

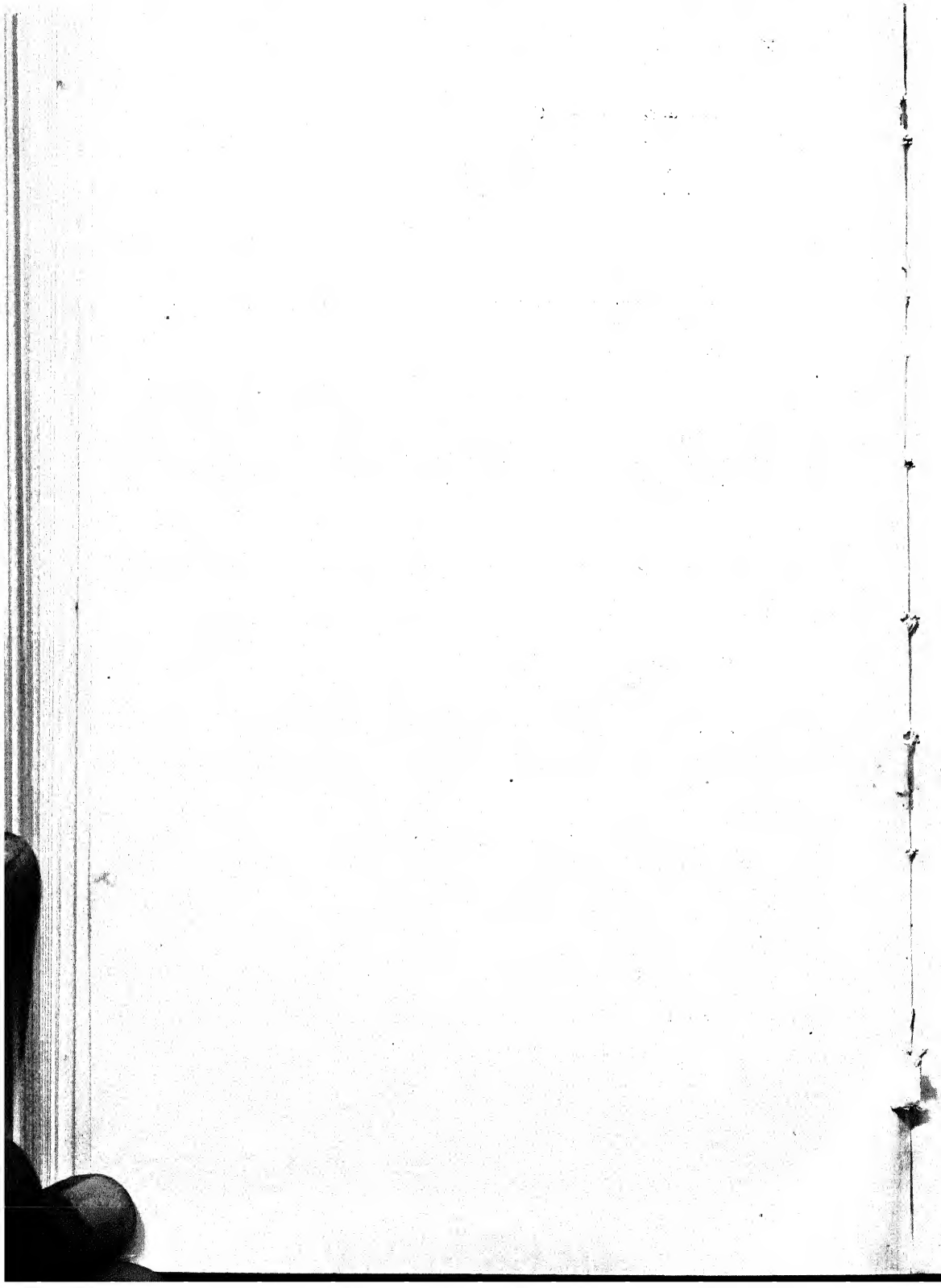
544. *Cryptoglena americana* Davis. Notes on the Life History of a Blue-green Motile Cell. Bot. Gaz. 19: pl. 11. 1894. De Toni. Syll. Algar. 5: 700. 1907.

Collins. Preliminary Lists of New England Plants.—V. Marine Algae. Rhodora. 2: 41. 1900.

Plate XX. fig. 24, 25.

Motile cells 5-6 mic. in diameter, 8-10 mic. in length, broadly elliptical, hyaline on one end, slightly truncate, with a depression from which arises a pair of cilia of unequal length, the longer one about as long as the cell is wide; cell contents blue-green, with six to ten disc-shaped chromatophores arranged around the periphery, and with one or two bright red pigment spots placed on the periphery, near the middle of the cell; non-motile cells 6-7 mic. in diameter, 7-9 mic. in length, arranged in groups of twos and fours in a closely packed Polycystis-like colony, almost uniformly colored blue-green, with six to ten disc-shaped chromatophores and one or two brownish red pigment spots near the middle of the cell at the periphery; nucleus near the middle of the cell.

Massachusetts. On stems of grass and larger algae. Salt marshes of the Charles River, Cambridge. Autumn. (Davis).



GLOSSARY

Adherent, clinging to, or united with
Adnate, touching closely or broadly
Agglutinated, glued together
Aggregated, forming a mass or collection, but not cohering
Amorphous, structureless
Anastomose, to run together in a net-like manner
Angular, having angles; sharp cornered
Apex, the end opposite the point of attachment; tip
Appressed, pressed closely against
Approximate, near, about
Aquatic, living in water
Arachnoid, cobwebby
Articulate, jointed with cells
Asexual, without sex

Base, the point of attachment
Brackish, somewhat salty
Bulbous, with a bulb
Bullate, swollen
Bullose, swollen

Caespitose, in tufts or dense bunches
Calcareous, composed of or containing lime
Calyptra, a cap or lid
Capitate, furnished with a globose head
Carneous, fleshy
Cartilaginous, firm and tough like cartilage
Catenate, joined in a continuous series; in a chain
Cell, a closed sac, surrounded by a wall of cellulose, containing protoplasm and a single nucleus
Cell sap, the watery fluid of a cell which separates from the protoplasm as one or more vacuoles
Cell wall, the membrane enclosing the cell contents
Cellulose, the cell wall substance of plants
Centrifugally, from the center
Centripetally, toward the center
Chlorophyll, the green coloring matter contained in plants; leaf-green
Chromatophore, a plastid, containing a coloring matter

Cilium (pl. *cilia*), one of the vibratile, protoplasmic processes which serves to propel zoogonidia through the water

Circinate, rolled from the end
Clathrate, with openings like lattice work

Clavate, club-shaped
Coalesced, grown together, united
Coalescence, the complete union of similar things

Collateral, side by side, secondary
Colony, a group of independent cells surrounded by a common investment; a mass of plants of more or less definite shape, large enough to be detected by the naked eye

Concentric, with a common center
Confluent, growing or running together

Conidium, gonidium; a gonidium which is abstricted from the apex of a stalk

Constricted, narrowed in certain places

Contiguous, near or in contact

Contorted, twisted

Contractile, able to contract

Convolute, rolled together

Coriaceous, leathery, tough

Crenate, wavy

Crisped, curled

Crustaceous, crust-like

Cuspidate, pointed, with a tooth

Decumbent, lying down

Deliquescent, dissolving

Dense, crowded together

Depressed-globose, globular, with the poles slightly flattened

Dichotomous, two-forked; furcate

Dichotomy, division into two branches

Diffluent, dissolving

Disc, any flat circular area

Disc-shaped, flat and circular

Dissepiment, cross wall

Distal, pertaining to the apex

Divaricate, spreading

Diverging, separating

Eccentric, without a common center
Elongate, lengthened, very long
Endophyte, a plant living within another organism, usually as a parasite

Entire, not toothed

Epiphyte, a plant growing upon the outside of another plant, but not nourished by it

Equilateral, with equal sides

Family, a mass of plants of microscopic size and somewhat definite shape quite evidently arising from the division of a single cell

Fascicle, bundle

Fasciculate, in bundles

Fastigate, tapering to a point

Fenestrate, window-like

Fibrillae, little threads

Fibrillose, made up of small fibers

Fibrous, of fibers

Filament, the trichome together with its sheath; a fine thread

Filamentous, thread-like, composed of filaments

Filliform, thread-shaped

Fission, splitting; cell division in which the cell separates into two nearly equal portions, especially as a mode of reproduction

Flaccid, soft, flabby

Flagelliform, whip-like

Flexuous, flexible

Floccose, composed of matted, woolly hairs

Flocculent, woolly

Foliaceous, leaf-like

Foliose, leaf-like

Gelatinous, jelly-like

Geminate, paired

Geniculate, bent abruptly like a bent knee

Genuflexuous, bent abruptly

Glaucous, sea-green, gray-green

Globose, like a ball

Globular, spherical or nearly so

Gonidium, the cell in which gonidia are produced

Gonidium, a reproductive cell developed asexually; a specialized reproductive cell capable by itself, of giving rise to a new organism.

Granular, with granules

Granule, a small grain

Granulose, with granules

Gregarious, growing in association, but not matted together

Grumose, grumous, like a cluster of grains

Habit, the general appearance or characteristic manner of growth of a plant

Habitat, the locality or region, or the kind of situation in which a plant is naturally found

Heterocyst, a cell uniformly larger than its neighbors, but of doubtful function

Hirsute, with coarse hairs

Homogeneous, uniform in character or substance.

Host, a plant which supports a parasite (or an epiphyte?)

Hyaline, clear and colorless, transparent

Immersed, sunken below the surface

Impregnated, filled with

Indurated, hardened

Inequilateral, with unequal sides

Inflated, swollen

Integument, any outer covering

Intercalary, inserted between

Intricate, tangled, involved

Inundated, flooded

Investment, a covering

Laciniate, torn

Lacunose, hollowed

Lamelliform, plate-like

Lamellose, with plates or blades

Lenticular, lens-shaped

Lubricous, slippery, slimy

Lumen, cavity

Mammillate, mammillose, with nipple-like projections

Mammilliform, nipple-like

Marginal, at the edge

Membranaceous, papery

Moniliform, chain-like

Motile, able to move

Mucilaginous, jelly-like

Multicellular, of several to many cells

Nodule, a little knot or lump

Nucleus, a differentiated round or oval body embedded in the protoplasm of a cell

Obovate, ovate, but with the point of attachment at the lower end

Ocrea, a sheath

Ocreated, sheathed

Orbicular, circular

Oval, elliptical

Ovoid, egg-shaped

Pannose, ragged

Papillose, with a little point or nipple

- Parasite**, a plant that lives on or in some other organism from which it derives its nourishment for the whole or a part of its existence
- Parenchyma**, the soft, thin-walled cellular tissue of plants
- Pedicel**, a small or delicate supporting stalk
- Pedicellate**, stalked
- Pellucid**, clear
- Penicillate**, like a brush
- Periphery**, edge
- Phycocyanin**, a blue pigment contained in the chromatophores of the blue-green algae
- Pigment spot**, a specialised mass of cytoplasm permeated by a red coloring matter, present in the motile cells of many algae; eye-spot
- Piliferous**, bearing hairs
- Pilose**, hairy
- Plant**, in the COCCOGONEAE a single cell; in the HORMOGONEAE a single trichome
- Plant mass**, the usually shapeless mass of individual plants remaining in close proximity to each other after their formation, either because nothing occurs to separate them or because they are definitely held together by a gelatinous excretion
- Plicate**, folded or ridged
- Polar**, at the end
- Polygonal**, many-sided
- Polyhedral**, many-angled
- Polymorphous**, of many forms
- Proliferated**, grown out
- Protoplasm**, the viscid, contractile, semiliquid, more or less granular, substance that forms the principal portion of an animal or vegetable cell
- Prostrate**, flat, lying down
- Pseudo-parenchymatous**, like parenchyma
- Pubescent**, finely hairy
- Pulverulent**, powdery
- Pulvinate**, cushion-like
- Punctate**, dotted
- Punctiform**, dot-like
- Pustular**, like a swelling
- Pyrenoid**, a small colorless mass of proteid substance seen in many algae, which may be regarded as reserve material
- Quadrate**, square, in fours
- Radial**, pertaining to a radius, as of a circle or sphere
- Rectilinear**, straight
- Refractive**, refringent, bending or turning aside as a light ray
- Reniform**, kidney-shaped
- Reproduction**, the development of one or more new organisms from the whole or from a part of the protoplasm of a parent organism
- Rotund**, round
- Rugose**, furrowed, roughened
- Saccate**, sack-like
- Segment**, one of the parts into which an object is naturally divided
- Septate**, divided by partitions
- Seriate**, in a row
- Sessile**, without a stalk
- Sheath**, a gelatinous, usually tubular, envelope surrounding a plant
- Silicious**, containing silica
- Sinuate**, snake-like, twisted
- Sinus**, a gulf or indentation
- Spatulate**, shaped like a spoon
- Spherical**, ball-like
- Spongiose**, spongy
- Stellate**, star-like
- Stratified**, in layers
- Stratum**, a layer
- Striated**, having fine markings
- Sub**, slightly, somewhat
- Submerged**, sunken
- Substratum**, surface on which the plant grows
- Superposed**, placed one above another
- Tegument**, covering
- Tenacious**, firm, tough
- Terebriform**, screw-like
- Terminal**, end
- Terrestrial**, growing on the ground
- Thallus**, a plant-body without true root, stem or leaf; used incorrectly instead of "plant mass"
- Tomentose**, closely hairy
- Tortuous**, twisted
- Torulose**, chain-like
- Trichome**, the entire number of cells of a multicellular plant, not including the sheath
- Truncate**, cut off abruptly
- Tuberculate**, tuberculose, warted
- Tubular**, tube-like
- Ultimate**, last, end
- Uncinate**, hooked at the end
- Undulate**, wavy
- Unicellular**, one-celled
- Unilateral**, one-sided
- Vacuole**, a cavity in the protoplasm of a cell containing a watery fluid

Ventricose , a swelling out on one side or in the middle	Vesicular , bladdery
Verrucose , warted	Villous , long hairy
Vesicle , a small bladder-like cavity	Zonate , disposed in the form of zones

Note: The proper terms to be used in connection with the blue-green algae have not yet become definitely established. The terms and definitions given in this treatise are merely provisional, in case better ones can be found. Some difficulty has been experienced with the terms: "plant mass," "colony," "family," "thallus," etc. The definition of each, as the author conceives the meaning, is given in the glossary.

Plant mass, the usually shapeless mass of individual plants remaining in close proximity to each other after their formation, either because nothing occurs to separate them or because they are definitely held together by a gelatinous excretion

Colony, a mass of plants of more or less definite shape, large enough to be detected by the naked eye

Family, a mass of plants of microscopic size and somewhat definite shape, quite evidently arising from the division of a single cell

Plant, in the COCCOGONEAE a single cell; in the HORMOGONEAE a single trichome. In the latter case it may be thought better by some to consider "plant" and "filament" as synonymous terms.

ERRATA

- Page 8, after line 26 insert Plate I, fig. 6
Page 26, line 23, for Hansirg read Hansgirg
Page 27, line 27, for **APHANACAPSA** read **APHANOCAPSA**
Page 39, line 37, for **Coelosphaerium** read **COELOSPHAERIUM**
Page 52, line 35, for smaragdinus read smaragdina
Page 52, line 37, for olivaceus read olivacea
Page 54, line 38, for smaragdinus read smaragdina
Page 55, line 4, for olivaceus read olivacea
Page 55, line 16, after 2. insert 1904.
Page 111, line 18, for Chondrocystic read Chondrocystis
Page 115, line 19, for sublilis read subtilis
Page 122, line 44, for symplocoides read symplocoidea
Page 129, after line 25, insert Plate V. fig. 48.
Page 130, before first line, insert Plate V. fig. 49
Page 140, first line, for 1-4 read 1
Page 160, line 3, after capitata insert (E. West Jun.)
Page 168, line 25, for depresed- read depressed-
Page 170, line 18, for natus Harpswell. read natus. Harpswell
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Page 181, line 9, before N. insert (
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Page 265, first line, for Indies read Indies

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